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THE MARINE REVIEW in its issue of Nov. 28, carried the proceedings of the fifteenth general meeting of the Society of Naval Architects and Marine Engineers to the conclusion of the discussion upon Prof. H. C. Sadler's paper entitled "Some Experiments upon the Effect of Longitudinal Distribution of Displacement."

Immediately following this discussion Commander A. P. Niblack read his paper upon the subject "Further Tactical Considerations of Warship Design" as follows:

In Volume III, pages 149-158 of the Transactions of the Society, is printed a paper on "Tactical Considerations Involved in Warship Design." Although 12 years have elapsed since this paper was read, the *further* considerations are more of a reiteration or restatement, than a shedding of new light on the question. This is because, in spite of the enormous strides in gunnery, ordnance, armor, torpedoes, ship design, marine engines and boilers, our tactical ideas are still dormant, or groping for definite expression.

To properly handle a fleet in the approach to the attack and in action, there is certain information which it is important to easily and quickly ascertain, and certain orders or information which must be transmitted to the other ships, or to other persons in each individual ship. In the original paper these were considered under three heads, viz.: (1) Interior Communication; (2) Exterior Communication (Signaling); and (3) Tactics. The same heads will serve our present purposes. The information which it is necessary to ascertain, to transmit or to know, from time to time is:

I. INTERIOR COMMUNICATION—(1) The compass course. (2) The speed. (3) The sight bar ranges. (4) The lateral compensation for sights. (5) The readiness of each division of the battery to fire. (6) The readiness of each torpedo tube to fire. (7) The helm angle. (8) The target ship. (9) The intactness of the hull. (10) The degree of heel of the ship.

II. EXTERIOR COMMUNICATION—(1) The distance and bearing of the guide or of the ship next ahead in the formation. (2) The exact distance of the enemy (target). (3) The course the enemy is steering. (4) The speed of the enemy. (5) The formation and line of bearing of the enemy in relation to your own. (6) The import of signals displayed.

III. TACTICS—(1) The plan of battle or the general tactical methods which are to be employed.

One of the least understood tactical considerations is the use of the compass. As a matter of fact, what counts in a fleet action is the angular difference between the courses or lines of bearing of the opposing fleets, from 0 degrees when the two formations are parallel, to 90 degrees when at right angles and one fleet is "capping" the other. The consideration of the compass course steered is lost sight of in the all-important necessity of keeping all of your guns bearing on the enemy all the time, and yet actual compass bearings and compass readings are necessary as aids to handling fleets and individual ships.

A helmsman, steering a ship, normally uses a definite compass course to steer by, but battle conditions require the captain to vary the heading of the ship either to obey a signal or to maintain position in relation to other ships in the formation (incidentally any changes of course disturb the accuracy of gun fire and the ideal condition is a fixed course, but the most we can hope for tactically is as few changes of course or disturbances of the helm as possible). As it is practically impossible to use a compass in a conning-tower, owing to the great mass of armor forming it, the only visual guide the helmsman has to steady him on a course is either the ship next ahead seen through a slit, or, better still, the enemy's target ship seen on one hand or the other through a slit. The conning tower gives protection, but is so defective for seeing that few commanding officers will consent to remain boxed up in them.

As all ships are fitted with conning towers it is idle to talk of their disadvantages. The requirement is to make them work.

This may be accomplished as follows:

Let us assume that the captain is outside of the conning tower, but that an officer, or trained petty officer with several assistants, is inside as a sort of a "central" for transmitting orders (the helmsman is also in the conning-tower). On the bridge above the conning-tower is the navigator at the standard compass with one or more assistants. He wears a head telephone, connected by wires with a head telephone worn by the officer in the conning tower. The standard compass is fitted with its azimuth circle and attached to the metallic compass stand is a light wire frame carrying a light high-powered telescope over the center of the compass bowl. Attached to the telescope, which can revolve in azimuth, is a pointer whose center is over the center of the compass bowl, and whose point reaches to about the "lubber's point." The angle which the pointer makes with the line of sight of the telescope may be varied and clamped at will.

The duties of the navigator are as follows: On the approach to the attack he takes the bearing of the head and rear of the enemy's formation. The range finding officer gives him the distance of the enemy's head and rear ship. He then plots to scale, on special plotting sheets, the course and formation of his own fleet and the distance and bearing of the head and rear of the enemy's formation. This gives a good idea of the line of bearing of the enemy's formation in relation to his own. This is very important to know, and the eye cannot judge it, but to check it he counts the number of ships of the enemy and divides the plotted length of the enemy's formation by the number of ships less one. He knows that 350 to 400 yards is the least distance they can be apart, so he can judge by the result whether the formation of the enemy is nearly parallel to his own or whether considerably converging. In other words, he can check the plotted results. Repeating the plotting at intervals, he can judge the relations of the enemy's course to that of his own. This gives data for setting the change of range instruments based on relative courses and speeds. As the fleet approaches battle range and the target ship is indicated, the navigator points the telescope at the target ship, and sets the pointer at the "lubber's point" when the ship is on the course being steered. From time to time he checks this up. Meanwhile, when signals are received by the signal staff on the upper bridge, he transmits them by telephone to the conning tower. "Central" informs the captain. The navigator also gives "central" all tactical information as to distance by range finder, formation of enemy's fleet, target ship, etc. He also, through "central," steadies the helmsman on the course and tries to keep her so in order to insure accurate firing. This in no way deprives the captain of the power to visually signal with his hand from outside the conning tower to "central" in the conning tower to direct any necessary change of course or correction of course to keep position in formation. In other words, the navigators' function is advisory as far as it does not conflict with the captain's directions. "Central" hears the navigator, but sees the captain. What the helmsman hears is what "central" tells him and what he *sees* is the ship next ahead of the enemy to enable him to steer steadily as he has no compass to go by. "Central" keeps the navigator posted as to change of course made by the captain. The fire-control system should provide for the corrections to data obtained as regards sight bar ranges, lateral compensation, etc. The captain gives the order to commence firing and cease firing, keeps position, and interprets signals. He can, through "central," regulate the speed and course, and get any information from him by means of the system of interior communication provided in the conning tower, or which the navigator obtains by methods of exterior communication.

This is the broad outline of the problem of handling ship in action, but there are many questions of detail on which few agree. It is merely suggested as one method of doing it.

I. INTERIOR COMMUNICATION—The fitting of ships with the means of interior communication is largely a commercial question. Money can buy mechanical devices which will accomplish almost anything. The progress which has been made in the last 12 years is satisfactory, except that with change of ideas, many instruments have been installed, in connection with fire control and battery indicators, which have been replaced by others to meet new theories. The inherent difficulties of interior communication are not nearly so great as those of exterior communication, particularly in signaling between ships.

II. EXTERIOR COMMUNICATION (SIGNALING)—Under this head, besides signaling, is grouped range finding and the ascertaining of tactical data with regard to the enemy (distance, speed, course and formation). This was discussed under the duties of the navigator, but there

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are two instruments which have not been generally adopted in our navy in this connection and these are a satisfactory range finder and a telescope. As to the last named it is difficult to understand why the Fiske telescope has not been adopted. It has been reported on favorably by a number of boards and the necessity of a mechanical, mounted, powerful telescope is self evident.

As to methods of signaling, some progress has been made. The wireless has come to stay, and wireless telephones are on the way. The two arm semaphore machines have been adopted, but they are unnecessarily heavy. No one method of signaling will ever displace all others. As stated in the paper 12 years ago, "No method of signaling is *per se* the best. The squadron (fleet) which has all methods of signaling has the advantage. Where there is need to signal in action, the need is pressing. Of course it is sought, in all battle tactics, to reduce the necessity for signaling to a minimum; but through the shifting conditions of smoke, noise, wind, distance, and accident to various methods, the resources for making the few simple battle signals should be all that modern ingenuity can devise." It is a curious thing that only in the last few weeks has this idea finally received official recognition. We have all along apparently held to the idea that flag signals were the only ones we could use in battle, for no provision has heretofore been made for quickly transmitting the same signals by other means than flags. Fortunately this incomprehensible conservatism has given way to a broad and full recognition of the principle that every method of transmiting battle signals must be developed to its fuilest possibility. "One code for all purposes of signaling, and every possible method of transmitting that one code." We have lost 12 years in doing it, but it means for tactics all that the recent change in gunnery methods have done for battle efficiency as regards our ships' batteries.

III. TACTICS—Homogeneity of battleships in a fleet is tactically ideal and practically unattainable as the units are designed at different times, by different people, and on different theories. One fact remains, however, and from that there is no escape, viz., the tactical weakness of any ship is the standard possibility of the whole fleet, particularly as to motor and turning qualities.

There are, for instance, several eccentricities in our present battle and armored cruiser divisions that are deplorable, viz., in-turning screws and out-of-date and indifferent steering gear. No question of expense should stand in the way of making good these defects. Nor should armored protection and heavy armament ever be sacrificed to speed, as speed is only attainable, without this sacrifice, by great increase in displacement. It remains to be proven that turbine engines are worth the tactical sacrifice due to injecting into our existing fleet units whose handling qualities are uncertain and so different from other ships. Radical departures from conservative methods are alluring, but where we balk at liquid fuel for boilers (which is largely a strategic question) why ignore tactical considerations in engine design.

As a matter of fact it would seem reasonable to wait for the coming revolution in methods of propulsion involved in internal combustion engines with no smoke-pipes rather than to follow all the fashions in European design. It is a common saying that we adopt ideas that are just going out of date abroad, but the relation of the tactical qualities of each ship designed, to those both building and built, should receive some consideration.

The proper point of view for the average line officer should be to make the most of the ships as they are. There is too little practice *as if in battle* to enable any one to pronounce our present arrangements defective, except in minor details. Gunnery is the best test of ordnace. Battle tactics is the best test of the battle qualities of our fleet.

There is today in our navy a tendency to formulate our tactics rigidly on the basis of rectangular movements. At the risk of being heretical, after so many years of being very orthodox, the writer is inclined to believe that in "sparring for position" in the approach to the attack, oblique movements have a possible use, rare it is true, but sufficient to justify a recognition of their not being altogether anathema.

DISCUSSION.

Capt. William Hovgaard: Commander Niblaek proposes to use the conning-tower as an intermediate communication station, the commander of the ship and the navigator being stationed outside the conning-tower, without any protection, on the bridges. Of course, conditions will occur where this plan will work satisfactorily, as for instance when facing an enemy of very inferior strength or efficiency; but, evidently, the service and the design of the ship must be based upon the conditions of a serious engagement with an efficient enemy.

In my opinion, as expressed in my paper on "The Seagoing Battleship," 1904, no men, not even the most unimportant, should be permanently stationed in the unprotected parts of a battleship during action, least of all the commanding officer and his staff. This opinion has been confirmed I believed by the experience of the battle of Tsushima. A brief description of conditions on board the Russian flagship, the Souvaroff, during the battle, based on the account given by Capt. Semenoff in his admirable book, "The Battle of Tsushima," will be sufficient to prove this statement. The Souvaroff, it appears, was put out of action almost entirely by shell fire, and more particularly by the Japanese 12-in. high explosive shell. These shells were very sensitive, they burst on striking the water, and even the slightest obstacle on a ship, such as hand-rails, guys, etc., would bring them to explosion. The charge of these shells was so large that they might be described as veritable mines, and their effect was threefold:

1. SPLINTER EFFECT. — Innumerable splinters and fragments were projected as a shower over the ship, causing numerous casualties, penetrating through gunports and sight holes, and damaaging all exposed objects such as signal gear, compasses or other instruments, fire mains and hose, etc.

2. BLAST EFFECT.—The shells seemed to act more by the blasting effect than by direct impact. Steel plates were torn in pieces, and huge openings produced in the unprotected ship's side, funnels and masts were turned over, the 12 pdr. and lighter guns were blown from their mountings without showing any sign of a direct hit, steel ladders were crumpled into rings, etc.

3. INCENDIARY EFFECT. The explosion of the shell was accompanied by an exceedingly high temperature, and what Captain Semenoff describes as a "liquid" flame, seemed to spread over and ignite everything. Hammocks, boats drenched with water, the wood on spar decks and bridges, and even the paint on the steel plating caught fire in a moment. To all this must be added the poisonous effect of the gases developed by an explosion.

About one hour after the commencement of the battle, the situation on board the Souvaroff was as follows:

The casualties were so numerous that reinforcements were required everywhere, even in the turrets, where splinters penetrated; the reserves were soon exhausted; dead men were left to lie where they had fallen, and there were not men enough left to even look after the wounded.

Most of the signalmen were killed or wounded and the signal gear completely destroyed.

Serious fires were raging on the upper and spar deck, among the boats and in the officers' quarters. The fire mains and hose were destroyed, leaving no proper appliances with which to fight the fire.

The starboard side of the bridges was destroyed and the ladders were gone, the spar deck had here fallen down and was burning in a bright flame on the upper deck, and the debris completely blocking the passage. On the port side the bridges were on fire, and burning hammocks blocked the ladders; the chart-house was also on fire. All men stationed on the bridges, such as the signalmen, had long since been swept away or driven under shelter.

The heat in the conning-tower now became unbearable, and the thick smoke prevented any possible outlook, the compass and all other instruments inside the conning-tower were destroyed, except the telegraph to one of the engines and a voice-pipe to the other. In the conning-tower at that time were Admiral Rozhdestvensky, who was wounded in the head, back and right leg, besides several small splinter wounds, the flag-captain and the navigator, both wounded, and three other persons. Five or six dead bodies were lying on the floor. Several other persons had been wounded in the conning-tower and were now in the hospital. It was determined to leave the conning-tower and to steer from the lower fighting position, but no passage was left from the bridge except through the armored tube. The dead bodies having been dragged away, the hatch over the armored tube was raised and the admiral and his staff let themselves down through the tube. Immediately after this, when the admiral tried to find another position from which he could follow the battle, he was severely wounded and incapable thereafter of leading the battle.

Two hours later the Souvaroff was reduced to a burning and smoking wreck, funnels and masts were gone, a suffocating smoke, drawn down through the ventilators, filled the lower parts of the ship, which were now dark and silent, the dynamos and engines having stopped for want of steam, and the men probably all

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having become suffocated. Of the crew of 900 men, probably not one-tenth remained alive, and of the guns, only a few of the smaller caliber were in working order. It must, however, be noted that the armor had proved most effective, the entire ship below the armor deck, including machinery and magazines, appear to have been intact, and even the 3-in. armor on the lower 12-pounder battery proved a most valuable protection.

It seems clear from this account, as well as from other accounts of the battle, that any plan for directing a fleet or a ship, in a serious engagement, from an unprotected position must be doomed to failure early in the battle. To place the captain and his staff outside the conning-tower is to place the brain outside the skull.

I believe, therefore, that the best solution is to control the ship from the conning-tower, and to design and locate this structure in such a way that it will become a relatively safe and efficient center for the activity of the ship.

It may be objected that the conning-tower of the Souvaroff proved anything but a safe place, but the reason of this was its very unsatisfactory construction and location, defects which were easy to avoid in future ships, and which may be largely remedied in existing ships.

The conning-tower of the Souvaroff had a mushroom-shaped hood, which left a continuous slit open, affording a good all round view, but the overhanging hood or roof would catch the splinters glancing upwards along the vertical wall of the tower and deflect them into the tower. Similar conning-towers are used in the French navy, while in most other navies the lookout takes place through isolated holes in the vertical armor wall, offering far less chance for splinters to enter.

I believe it possible to improve the construction of conning-towers very considerably, but in order to attain this object we must be prepared for greater sacrifice in weight than hitherto.

The conning-tower should be of ample size, eventually in two stories, one for control of the ship, the other for control of the guns. Access should be at top and bottom, the top hatch eventually used for lookout when circumstances permit. The holes should be surrounded for external projections so as to deflect splinters and should be provided with heavy armored shutters, easy to open and close. These features contain nothing new, they having already been either used or proposed, but are not generally found in existing ships.

I now further venture to suggest the following features as protection against splinters:

Vertical radial screens, about 2 ft. deep, should be fitted on the inside wall of the conning-tower. These screens should be placed between the sight-holes and carried from the floor to the level of the sight-holes, forming a sort of stall at each hole, eventually closed by swinging doors on the rear.

The man at the wheel, the steering mechanism, the compass and other instruments, should be also as far as feasible protected by special screens. The inside walls of the conning-tower should be coated with a thick layer of some plastic cement, in order to prevent or deaden the rebound of splinters.

The officers and men stationed in the conning-tower should be provided with metallic helmets, protecting head and shoulders against splinters.

As to placing a compass inside the conning-tower, its directive force will always be weak, but it can generally be made useful as a guide for keeping approximately a given direction under circumstances where the view is obscured by smoke or fog, even if it is not sufficiently reliable for navigation.

The view from a conning-tower is, of course, restricted, but it is a matter of experience that this difficulty may be largely overcome by practice.

As to location, the conning-tower of the Souvaroff was imbedded between two bridges with wooden decks, both inflammable and full of fittings which would catch the shell and produce splinters. The upper bridge was overhanging the conning-tower on both sides, and would, even if undamaged, partly obscure the view of the horizon, when the ship took a heel. When demolished and burning, this upper bridge, together with the burning lower bridge, put the conning-tower out of action.

The location and surroundings of the conning-tower of many, if not most, existing battleships, both American and foreign, present essentially the same features as in the Souvaroff, and in some ships the conning-tower is moreover directly surmounted by a ponderous mast with military tops.

To make the conning-tower a safe and reliable station for directing the ship, it should be placed entirely free, neither surmounted nor surrounded by any structures, and well forward of the bridges, the mast and the funnel. The bridges should be reduced in size to a minimum, and no wood should be used in their construction. Nor should any wood deck be laid on unprotected superstructures, even if placed on a steel deck.

It appears to me very important that those lessons of the late war should be acted upon, not only in new ships, but also in existing battleships and armored cruisers. Notably the bridges, superstructures and masts which do not conform to the above claims should be reconstructed.

Lewis Nixon: I am sure I voice the opinion of all the technical members of the society in welcoming articles of this sort, because it is most important we should get the point of view of the men who are fighting the battles of the country, and who command the boats which are built for the navy after they are in service. In the merchant marine work, which we have before us, our limitations are clearly defined by the service which the boat is to perform, and we have to build our boat to meet that requirement. But in the case of the boats built for the navy, the more we get the point of view of the fighting officer, the man who is in charge of the ship, the better, I believe, will be our ship.

As to the question of the conning-tower, there is one point which seems to be of considerable importance. I sat through a conference wherein the question of conning-towers for use in designs in the light of the experience of the past war were carefully gone into, and they were specifying, among other things, a non-magnetic armor for the conning-tower. Just what is to be done in that line I do not know, but if other nations can get non-magnetic conning-towers, certainly the United States can.

As to the question of holding a fixed course, that is, one which involves elements of tactics, and I feel sure that American ingenuity will solve it by some form of gyroscope, and at the same time be able to depend on the reliability and steadiness of such an instrument. In the submarine work, where they make conning-towers with non-magnetic armor, they have not so much trouble in steering straight courses.

I cannot discuss the subject of conning-towers, without subdividing it under several heads, under any circumstances. The question whether an officer should expose himself, and not remain in his conning-tower, is a question largely for the officer who is in command of the ship, and he is going to settle it, as a rule, to suit himself. Precedents seem to have led to many of the officers of the American navy standing outside, but that the proper place is in a large conning-tower with plenty of room for motion, where the various accessories and auxiliaries for handling the ship are conveniently placed, easy of access, and easy of manipulation is unquestioned. That the officers will ever wear a kind of armor is somewhat doubtful, to my mind.

As regards the question of the use of different types of battleships, in armored tactics, I am not sure it is not the desire of the author to lead us to believe that he is extending the simile of the chain in its weakest link, because it will undoubt-

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edly be found that every boat in a line of battle is of use. One of the matters which I think is open to the greatest amount of criticism in the design of American ships is the necessity for a larger supply of ammunition, and it is very probable that the commander-in-chief who has to look at matters from the point of view of using his resources to the best of his ability, may use some of the old battleships more to draw ammunition than for any other reason, and so it seems that some of the ships might be used in the operations incident to a battle to draw ammunition which is now carried in too small quantities.

Insofar as deck structures are concerned, some of them are useful and some are forced on the ship by the design of its motive power. I cannot believe in any future ships there will be wood used for anything whatever. I think it should be cut out entirely. People may not agree with me, but ships are built to fight, and wooden splinters are certainly not to be invited in ships of modern design.

I came more today—I have such a cold I can hardly talk—I came more today to discuss the point of view brought out by Commander Niblack as to the use of the internal combustion engine. He has asked me to tell you something of what I know about it, and the question of its adaptability for marine purposes, probably on a large scale. I am not going to get into a controversy with those who believe in a turbine engine. The turbine engine has come to stay as a development of the steam engine. Whether its want of flexibility and the great refinement required in order to make it thoroughly efficient, in the way of special methods of getting vacuum, dry steam, all of which refinement if tied to the reciprocating engine of the best design would probably lead to the reciprocating engine doing as good work—whether these special requirements will stand in the way of its general development remains to be seen. As far as I have been able to gain information about the turbines, they weigh more, occupy more space and burn more coal for the same power, but my principal objection to them is the fact that they tie us to that form of generation of power which should be done away with on all boats that are modern, and that is any form of steam boiler. Steam has been used because we had nothing else to use, it has been used because it has developed from the fact that when men of far seeing ability, such men as Ericsson, started their internal combustion engines they found themselves, on account of the lack of development in the mechanical art, driven to such enormous cylinders for the use of their power that they could not practically make resistance, so that the men went in the line of least resistance and took advantage of the vacuum and condensation of steam. This gain of 15 pounds, was, of course, of tremendous importance, but if the art of the metal worker had progressed to such extent at that time that we could have used high pressure in internal combustion engines, pressures of such height, at least, that the gain of 15 lbs. could have been ignored, I believe today that internal combustion would be the universal method of generating power and that flying machines would be a necessity of modern civilization. But we must use the human element. You are going back to the old man-fired boiler as you must do with coal, and the conditions in the fire room are inimical to all of us. It would take a Dante to take care of a modern furnace on the second or third day out on a trans-Atlantic liner. We have put up with it because we did not know how to avoid it. The men come out of the fire rooms exhausted and the strain on the engine crew on account of the intense heat is terrific, and the emancipation of the man-fired boiler is a matter to which the naval architects of the world must turn their attention. That is all very well to say, when they cannot do it. Another thing is that in the later destroyers they have found it almost impossible to run many hours without cleaning fires, and burning enormous quantities of coal. They have gone to the use of crude oil in Great Britain for firing, and that is a commonsense and convenient method because the men in that case will not be under the strain they are under in the coal-fired boiler. I remember many years ago going down to see one of the first oil burning steamers lying below Philadelphia, at the junction of the Schuylkill and Delaware rivers, and we found four Chinamen in the fire room running the entire set of boilers, while with coal-fired boilers we would have had many men sweating and pouring out their strength and energy in piling coal on a coal-fired boiler. The doing away with hand-fired boilers is possibly more important on land than it is at sea, although in some cases at sea the conditions are worse than they are on land. A battleship or cruiser has intermittent service, and we want the men in the best possible condition. They cannot tell how long they will be in action, or how short may be the time, but if they can be emancipated from the firing of the boiler a tremendous advance will be marked.

As regards the gas engine, many people who have not examined into the matter seem to want to take the position that it is something which requires to be developed, and I must take issue with Commander Niblack in this respect, because he speaks of the "coming development" of the gas engine. It is already developed, and will deliver the goods when called for. So far as the work done under my own personal observation is concerned, and Commander Niblack asked me if I would not say a few words in regard to that, we built a fleet of ten boats two and a half years ago, developed in a practical way. Application had been made to builders in Europe for torpedo boats carrying 45 centimeter tubes, 47 millimeter guns, two automatic guns, making 20 knots speed and carried on a car. That problem was turned down in Europe and said to be impossible. They applied to America, and America said it could be done, and asked how long the boat would be and how wide. We were told 12 ft. wide and 100 ft. long. For some reason the thought occurred to me it would be wise to ask for a plan of the tunnels, and on plotting the tunnels we had to reduce the length to 90 ft. and the beam to 11 ft. 3 in. The boats were built and developed 20 knots easily, after some trouble with the screws, the first speed being 17 knots and the second 20.6 knots. They carried all the armament specified and two extra automatics, and gave 2,000 miles endurance instead of one. There has been very little said about that, naturally, because they were built for fighting. There was some doubt cast on the possibility of doing it, the boats too light, and could not go to sea, and could not be used at sea, and so on. One was built and sent across the ocean without any form of company or consort, and went the distance of 7,000 miles absolutely under its own power without any difficulty or trouble. That has not been done by steamboat destroyers of ten times the displacement. I have gone abreast a column of destroyers of 450 or 500 tons, in the Black sea, and not a black squall in the middle of the day, and with a little boat have been able to pass the destroyers whose speed was knocked down to six or seven knots in a heavy sea. It shows that small boats can be built that are absolutely seaworthy.

There is an important practical consideration involved in the design of the boats in keeping with the paper, that is to say, a fleet of boats has been developed for general fighting ability, and seaworthiness, and put on a car and sent to any part of the country; that is of immense stragetic importance, and the same thing could be done to take boats to Galveston, and send them across the Pacific, or by way of the Panama canal, if necessary.

The development of the gas engines for large boats will, of course, be based on the coal producer. There is no mystery about the coal producer, practically a banked fire, there are producer gas plants in Jersey City running five or six years,

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and some of them have not had their fires drawn for eight, nine or ten months in succession, and some of the engines are run five or six months without stopping. It is a record, which I do not think can be equalled by any steam plants of similar character and work. The doing away with lines of pipe under pressure and with sparks at night and smoke by day is, of course, of tremendous importance. The great improvement, however, in the design of a battleship, is in the doing away with an enormous amount of deck structure, ventilators, high smoke stacks and matters of that sort, and this can all be done away with in the use of gas engines. Of course, the exhaust of the gas engine must be taken care of, but that can be very easily done by a system of ventilators.

Here is another point which is important from a practical standpoint, and that is a few weeks ago four boats were sent to San Domingo, and went down without the slightest trouble in the winter time, and the gentlemen who ordered the boats was deploring the fact that he could not get fresh water on shore and did not see how he could get it off the boats. A distilling plant was put in and connected with the smokestack, and the exhaust products from the gas engine operated a distilling plant which gave the crew all the fresh water they required.

The use of the internal combustion engine is something which must be considered by us; it is forcing its consideration upon the people abroad, and I am sure the United States, which is never in the rear, will accept the challenge from abroad, and develop the internal combustion engine in the near future, for as long as you tie up to the man-fired boiler I do not think you can produce the best fighting ship or the best commercial ship.

Mr. Anderson: Mr. Nixon made the statement that turbine engines were heavier than reciprocating engines. Having been interested in the matter of steam turbines somewhat, I would like to point out, as regards battleship turbine engines, that the battleship turbine engine is considerably less in weight than the reciprocating engine. In most of the destroyers which have been made in England, there has not been a great saving there, due to the conditions which are laid down by our British Admiralty in giving certain conditions of test, and things which put the scantlings of the turbines much heavier than they need be.

Mr. Nixon: Was that a question directed to me, as to where I got the information?

Mr. Anderson: No sir, I want to give my views on the subject. In cruisers too there is considerable saving in weight, even with the cruising turbines being built. As regards space, length is required for cruising turbines, as they are required to be fitted, but height in the engine room is not, no more height is required other than the usual protective deck and that can be extended right over the engine room.

Mr. Nixon: I do not want to make a charge against the turbine engine. I remember the discussion of the 1,000-ton armored cruiser, where it was found if turbines were used much more space would be required, and the requirements of the space led to greater weight. Our government gives us latitude in the case of destroyers of several tons, for the turbine engine, than for the reciprocating engine.

I tried to get some really reliable data last year concerning the turbine, and went four times across the English channel on turbine-driven ships, and on those short trips endeavored to find out something. I made good friends with one of the engine staff, and had several drinks with him, and on the last trip he said that it was hard lines that he had not been able to tell me much more about the turbine, but he patted me on the back and said—"I am very sorry, but I cannot tell you nothing but the good."

John Reid: I should be very sorry to attempt to criticise or discuss any of the nautical features in this paper, which is interesting and valuable to the land lubbers, but there is a mechanical feature which I should like to refer to. The statement is made on page 4: "there are two instruments which have been generally adopted in our navy in this connection and these are a satisfactory range finder and a telescope." A great deal has been said in regard to the sailing of the battleship fleet to the Pacific, with regard to the necessity of having to fit a fire control system to the various vessels in a great hurry, and I would like to say it occurred to me that the absence of a range control system is a matter of much more seriousness and moment than the fire control system. The question is, is it because the range finder is not necessary, or because it is not a good one? With all due respect to Commander Niblack, and I would like his views on the point, I would say that a range finder in a battleship at the present time is absolutely essential in proper shooting. We know that the ranges in the late battles between the Japanese and Russian fleets were sometimes at a distance of seven miles, from five to seven miles, and if any one thinks what a big ship looks like at a distance of five to seven miles, one begins to consider that there is a greater necessity for some accurate system of finding the range. It would be, pretty much as if we should go up on the top of this building and look at a battleship coming in through the narrows, and take a shot at it. I do not think we would get much chance to hit it, at least for the first few shots; of course, I am aware it is possible to get range of a vessel without a range finder, even when ships are moving past each other, but there are other features besides this—suppose the responsible officer on a battleship gets the range of his enemy, how can he transmit that information in the heat of action or communicate any information to the other stations? I think that is the most serious part of it. We can hardly contend that it is proper and reasonable to make the various gun commanders to be making estimates of the distance of the ships they are shooting at in the heat of action, particularly when these ranges are rapidly changing and there are a dozen other things that the commander of the gun station is far more likely to have called to his attention. You can have sight shots, of course, but one wants to save ammunition, one does not start firing shots, or at least one would not want to have humorous sight shots without hitting pretty quickly. In a naval engagement it seems to me the whole issue will pretty much depend on who gets the first shot in, and if in a battleship you have a Shimose or Melinite shell around your conning-tower, you would probably indorse the sentiment of Sherman that "War is hell."

The question is—is there a proper range finder? I submit there is a practical range finder, and a good one, and while I have no brief from range finder makers, nothing to do with mechanical instruments, I would say that the Barr & Stroud range finder is a practical instrument and adopted in many navies and something that is essential in the equipment of any first class warship today.

Commander Niblack: All our ships are fitted with range finders.

Mr. Reid: I was taking your statement from this paper.

Commander Niblack: What we want is a satisfactory one.

Lieutenant Radler de Aquino: They are used in the Brazilian navy.

Captain Hovgaard: They are used in all navies.

Mr. Reid: It is a case then whether the range finder is satisfactory or not.

Commander Niblack: That is the point.

Lieutenant Radler de Aquino: The Barr & Stroud range finder is considered the best range finder.

Mr. Reid: Apart altogether from the sucess of the range finder, whatever type you use, the question is its adaptability to circumstances, and the speed by which you gage your range and the means used to communicate that range to the various stations. That is of importance, and it is important where you put the range finder. There are many different opinions

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on that subject, but in all the most recent ships of the English navy there are special sight stations fitted in the foremast which have proved satisfactory, they have yet to be tested in actual war, but I think if there is time for it to be done, and I should be sorry to take up more of the time of the society, I should like to hear from Commander Niblack in what feature the Barr & Stroud range finder is not satisfactory.

P. H. Kemble: In connection with the use of the internal combustion engine on warships, there is one point not brought out, and that is the noise of the exhaust. A year ago I spent considerable time and much tribulation in connection with gas engines, as I was very much responsible for the design and construction of two gas engine driven power plants in Boston where, as the plants were situated in the residential district, it was of vital necessity to suppress all possible noise of the exhaust. The manufacturer of the engine took a crack at it and several thousand dollars were spent in trying to suppress the noise, with plenty of room available on dry land, which would not be the case on ship board, and every effort was made to put the noise of the exhaust where it would not be objectionable and avoid suit with the local residents and also with the board of health. I think the hardest part of the application of the internal combustion engine to warship design would be to obviate the excessive noise of the exhaust, and I ask Mr. Nixon, as having had more experience with the high speed marine engines, what success he had on large engines in getting the exhaust so that it was noiseless? Now imagine what would happen to a cruiser or scout that was trying to obtain any information with the average noise of even a 500 or a 600-H. P. gas engine.

Mr. Nixon: We have no trouble whatever with the exhaust noise. The boat I spoke of has a 600-H. P. gas engine, and the noise of the exhaust from the engine is easily overcome.

Mr. Kemble: That is not the case with the gasoline driven engine—how about when it is carried to 1,000 or 2,000 H. P.?

Mr. Nixon: We simply subdivide our mufflers.

The President: Is there any further discussion?

R. H. M. Robinson: I was not here when commander Niblack read his paper, but I got here during Captain Hovgaard's discussion. It is hard to hear in the back of the room, perhaps I did not understand him correctly, but I was of the impression that he said that existing designs had the same number of bridges over the conning-tower and same general arrangement of the masts that had been the custom in the past. It may interest us to know that more recently it has been the endeavor to keep the conning-tower clear, and the reason for fitting bridges in the past was that the sea-going officers find it more convenient to maneuver the ships, in peace time at least, from the bridges than to do it from the conning-tower.

I think we will all agree, so far as practicable, that we should meet the wishes of those who are going to handle the vessels of war; it is sometimes difficult to meet the wishes of all of them, because there are so many of them with varying opinions on some of these subjects, and in our endeavors to do what the sea-going branch want us to do, we might do something that would meet the wishes of certain officers entirely, and in other respects we might not be so successful with other officers. I think, however, that lately anything like unusual erections and obstructions on top of vessels are being agreed upon by both those who handle the vessels and those who put them together, as undesirable, and probably in the future there will not be as many as there have been in the past.

Captain Hovgaard: I only refer to the existing ships, by which I mean ships which have been built. The existing designs I am not acquainted with and have no comment.

Prof. A. J. McLean: In listening to the discussion of this paper it seems to me one particular point has been omitted, and that is on page 5, where the officer speaks about the deplorable condition of some of our battleships in the matter of in-turning screws and out-of-date and indifferent steering gear. I think the steering apparatus in these ships should be one of the principal items that should be put right. We have constructors here who have charge of designing of our warships, and I think they should answer that fully to us.

The President: Does any one arise to defend the indifferent steering gear? If not the chair begs off. We would be glad to have Commander Niblack close the discussion, if there is nobody else who desires to speak on the paper.

Commander Niblack: I will say a few words in regard to the conning-tower: My indictment of it is merely that there has not been any progress for so many years we have got to find methods of utilizing what we have, and as to the question of how far we can make a better conning-tower that is something a little bit outside of what I started to do. I started out to demonstrate simply that I think the conning-tower in our last ships is very similar to that in our first ships.

With regard to the question of homogeneity, I do not want to be misunderstood in regard to that one statement, that would imply that an older ship scaled down to express it exactly, with the tactical weakness of any ship, is a constant possibility, and particularly as to the matter of turning qualities. There is no reflection, for instance, on a ship like the Oregon intended, because the Oregon design has had less to take back than any other ships, armored ships, that have been designed, because the tendency has been to come around towards them again rather than away from them, and I simply want to say regarding the matter of turning qualities, if ships turn differently, by reason of indifferent steering gear, steering gear that keeps failing and is unreliable. Take for example, one of our fleet trials, and see ship after ship falling out of line for five and ten minutes, so as to make repairs to the steering gear, it is very discouraging. It is not encouraging either, to see ships identically designed fitted with experimental steering gears of various kind, electrical, steam and hydraulic, and these three ships differently equipped cannot have the same tactical qualities. This is all a question of keeping your position, and when you are in column, in action, the question of being 100 yds. out of position is a very important one, and ships that steer badly or indifferently from leaving in-turning screws, and the advantages of in-turning screws are well recognized in regard to the convenience in the engine room—and the steering gear being faulty through one thing and another, and without naming any of the ships with these various types of steering gear, it is impossible to tell what is going to happen with ships with in-turning screws, when you put the helm one way or the other suddenly, and you make a guess which way they are going, and you cannot control the extent of how erratic they will be as compared with what we know to be the action of out-turning screws in reciprocating engines; in other words, we have a great many improvements in motive power and steering gear, and that sort of thing, which simply from a practical standpoint, do not give any increased advantage to the fleet in the older and weaker members; in other words, we still remain with five splendid battleships, with quick-turning power like the Satsuma, and some of the other ships designed by Sir Philip Watts, and which are of less service from a practical standpoint in the presence of a lot of older ships, or ships of different design, or ships in which the steering gear is indifferent.

To come to the question of range finder; the range finder jars out of position, all range finders, practically, undershock give varying results. It is recognized that it is almost a hopeless question. But there is a use of the range finder which is to give relative ranges, that is change of range; the range being determined by some means or other, the range finder being in good working order at

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first, after once getting the range, it is useful in getting differences in range; in other words, the change of range that we are after, so that a range finder, even though it may not give an absolutely correct reading, if it does not jar out of position, is quite valuable, and that leads to the whole question of conning-tower, range finder, and position of the commanding officer, and all of these other things which are related to this subject. It is recognized that the first advantage is a great one.

With regard to splinters and with regard to other questions that have been raised, it seems to be a matter of very small importance where the captain is killed. It is not less dangerous to be on an open bridge apparently than to be in a conning-tower, in fact, in the case of splinters we have come to accept the meaning of splinters as having something to do with wood. As a matter of fact the splinters are the iron stanchions, bolts, nuts and fragments of every kind are splinters, and in the open it would seem if there is nothing to stop the flight of a projectile, even an awning stanchion, for instance, might of itself cause a projectile to explode that would otherwise go harmlessly over the ship, and in the open it is hard to say whether a person is in any more danger than where he is screened. To specify a position where an officer shall locate himself in battle, is very much like the period arrived at where an armor was worn in olden times, and it became so heavy it was discarded, and in this question of handling ships in action, it would seem that it is practically impossible to protect the officers, absolutely, and it seems to me that whatever devices are provided for their protection they must necessarily take some chances in action. The conning-tower is where it was when originally designed, speaking freely. There is room for improvement.

There is one point with regard to Mr. Nixon's statement with relation to torpedo boats or patrol boats. I had gathered that they had not been extensively used, but at his request he has given me an official statement from a reliable Russian newspaper showing that the experiments that have been made with the Baltic seashore defense has been successful. The article is as follows:

The *Novoye Vremya* of St. Petersburg published the following from the *Kronstadtsky Viestnick*, the official naval organ of Kronstadt navy yard:

The experiments that have been made with the Baltic sea shore defense squadron of patrol boats, on the word of the authorities, have shown that under the present state of motor construction these boats furnish excellent weapons against an enemy's sudden attacks upon points of the Baltic sea.

The motors are run by gasoline, are of 20 knots speed, carry torpedo apparatus and guns, and on this account could best be termed harbor defense torpedo boats.

The seaworthy qualities of the boats are good. The vessels on a straight course steer without moving the wheel.

The President: The society extends its cordial thanks to Commander Niblack for his valuable paper. There is probably no member of the society who is so cordially welcome to this arena as he is. The chair regrets, however, that the discussion upon some of the interesting points he has raised has been inadequate and the chair feels bound to say in defense of members of this society who will not speak for themselves, that no one in this world manufactures or designs better steering gear than is made in the United States and fitted to its battleships. There is quite a difference between an indifferent steering gear, and a steering gear in indifferent condition. We always see in the first dispatches relating to a collision between battleships, that something happened to the steering gear, but I have yet to see in the final investigation where blame was located on the steering gear definitely and finally. Mr. Nixon will certainly be most cordially encouraged and welcomed when he shows us the advantages that are undoubtedly within the range of the internal combustion engine. Everybody will welcome that development. It is regretable, however, that he looks with such dark glasses upon the turbine engine. It seems to me to be sufficient to recall to his notice that whatever faults he finds with the turbine engine, it has accomplished, it is accomplishing today, what no other engine in existence can do. All the comparisons that can be produced to the contrary, the monumental performance of the Lusitania and the Mauretania are sufficient; no one wishes to undertake the results we require in the use of torpedo boats with reciprocating engines. I do not believe anybody can produce the results in the modern battle boats that are going to be required with the reciprocating engine.

Adjournment was then taken until 2 p. m. Thursday.

THURSDAY AFTERNOON'S SESSION.

At the opening of Thursday afternoon's session the following letter from Sir William H. White was read:

Cedarcroft, Putney Heath, S. W.
Nov. 12.

My dear Sir—You are already aware that pressure of unavoidable engagements here has prevented me from having the pleasure of attending the meetings of the society on the 21st and 22d inst., and from making a contribution to the proceedings.

I now write to ask you to express to the president and the members of the society my hope and full assurance that, in their new home and with the more favorable conditions now prevailing, the future of the society will be even more successful than its past. I value very highly the distinction of honorary membership of the society which was conferred upon me three years ago.

Yours sincerely,
W. H. WHITE.

Mason S. Chace then presented his paper entitled "Submarines of Battleship Speed," to the text of which attention will later be paid in the REVIEW.

DISCUSSION.

Capt. William Hovgaard: I think this paper gives a very clear and very comprehensive discussion on the question of submarine vessels. It does not lose itself in the history of the past. It discusses conditions as they are today, and moreover it gives a look into the future by discussing the possibilities of future developments, indicating the means, the way which we have to go to further improve the submarine boats and giving figures and facts in connection therewith. I see that Mr. Chace gives as the charge of passive mines five hundred pounds. That seems to me extremely great, I was not aware that passive mines could be made efficient with such great charges. In waters where there is a tide I was under the impression that such great mines would be liable to be deflected so much by the tide that they were not efficient, but I presume that Mr. Chace has good ground for his statement.

As to the shape of the Japanese boats, which Mr. Chace mentions as having an oval section with the major axis vertical, I think that section is best for the small boats, because it permits you to utilize the whole length of the boat by giving sufficient headroom throughout the boat either forward or aft. When we come to larger boats, it seems to me likely we shall have to invert the oval, and must come to ovals with the major axis horizontal, for the reason that the headroom is a fixed quantity, at least there is a minimum headroom which we must have in all boats, large and small. On the other hand, it is undesirable to increase the vertical depth of the boats, for the sake of handling, and so when we come to larger boats and larger displacements, say about 700 tons, it seems to be likely we will have to maintain a certain minimum of vertical depth, while we naturally increase the length and beam for preserving a certain desirable proportion between length and beam. That can only be done if we come to oval sections with the major axis horizontal. I pointed that out in 1887 in my book on submarine boats, but it occurred to me

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in connection with this discussion it might be interesting to mention it again.

P. H. Kemble: On page 20, at the top of the page, Mr. Chace makes this statement: "The consumption of the main engine may be taken as one pint per horsepower hour at full power and five-eighths pint per horsepower hour at half power." I understand that to mean when the engine is running at reduced power it is more economical than when running at full power, which seems rather an unusual condition for internal explosive engines.

D. W. Taylor: It seems to me that Mr. Chace in this paper has touched upon what is really the most vital point in the development of submarines. For several years on various occasions I have asked the managers of our battleships what they would do if they had their ship in the vicinity of submarine work, and that is one question upon which our naval officers are in absolute agreement. They all said they would probably get away. So far, the submarine has never been given sufficient speed to enable it to catch a battleship. It looks to me, if we had a submarine which could catch a battleship, that question as to what they would do in the event of a submarine being in the vicinity would be a difficult one to answer. The fact is the battleship has not developed any antidote for the submarine. The defensive powers of the submarine are practically unlimited, because it can go under water, and we have no weapon, so far, capable of attacking it under water, so that the question of the possibility of the increase of speed of the submarine is very important. Mr. Chace takes no very strong ground one way or the other, but I rather think he believes the true plan of development is to produce the surface speed and hold to the submerged speed, the submerged speed being secured by the storage battery, and the surface speed being obtained by the gasoline engine.

With reference to Mr. Chace's remarks on page 10 as to the question of the depth of submergence, it seems to me that the qeustion of submergence, with or without the crew, has very little bearing. If the boat is submerged a certain depth without the crew, it seems there is no reason why it should not be submerged with the crew, it is simply a question of what is best to do. I will point out with regard to the depth of submergence that the United States is peculiarly situated in this connection, because it has a very long coast south of Boston, where the water is very shallow, and there are very few spots, indeed, south of Boston where you can obtain 200 feet of water without going a long way outside of the line, and for that reason the advantages of submarines, which can withstand a deep submergence test, are greater for the United States than most other nations, where you may find depths of 400 or 500 ft. within a very short distance from land.

I was very much interested in the deductions as to the possibility of speed. I ask him, with reference to page 13, if submarines of less than 100 tons made over 12 knots speed. I ask him, if he is at liberty to answer the question, whether those boats were as much as 100 ft. long?

Mr. Chace: I should not care to give the dimensions, they were not the same as the impulse test in the model tank in Washington; they were modified before the boats were built.

Mr. Taylor: The reason I ask the question is because we have made a number of experiments with models of submarines, which appeared to indicate that there is a certain critical speed, beyond which the model has a strong tendency to dive. We remember the case of the English submarine a few years ago which was participating in some maneuvers and took a header and went down and drowned nearly all the crew, and even before that we made a number of models and found apparently there is a critical speed at which such things happen. We have done it on models, and as the speed increases they take a header and go down. That speed is tolerably high, and personally I should be much averse to going on submarines, unless it had a very large emerging displacement, which had sufficient power to drive it at a speed greater than one and one-quarter or one and three-tenths times the square of the length. If you will look at the diagrams in plate 1, you will see that that speed goes beyond the hollow in the curve, that is to say, all of these vessels would be safe for a comparatively small reserve of buoyancy up to some point at which the power begins to rise very rapidly, beyond a hollow in the curve, that is with a 100-ft. boat up to a speed of 13 knots. It was that fact that made me interested in knowing the length of the boat that made 12 knots, it was probably not a large boat, not over 100 ft.

Mr. Chace: In regard to the question of mine charges that Capt. Hovgaard brought up, I can state that I have seen actually under construction mines which were designed to be used as freely floating mines which had that charge of 500 pounds, so there can be no question but what charges of mines actually used reach that amount, or exceed it.

As to the possibility of placing the long diameter of the oval section horizontally as suggested by Capt. Hovgaard, I remember reading his article on that subject to which he refers. If we reach ovals of very large displacement, possibly there will be a development along these lines, especially in so far as the aft body is concerned, where it may be an advantage to use the oval sections with the long diameter of the oval horizonal, particularly if triple screws are used as suggested.

Now, as regards the question of consumption, that is an error, I should have said five-eighths of the full power consumption at half power. These notes were dictated, and not revised, and in this way the error crept in. The half power consumption is five-eighths of the whole power consumption; that is the fact which holds. The figures and comments which are given as to radius are in no way affected by this typographical error.

As far as the question of increasing the surface speed and maintaining the same surface speed, that is really the thing I had in mind in writing the paper, to draw attention to the fact that a higher surface speed is absolutely necesary if we are to place the submarine where it can fight effectively against large ships, making the speed which these large ships do make; higher submerged speed than these actually obtained do not seem to be necessary, but great importance should be attached to increasing the surface speed; this is particularly important in the case of off-shore works against large ships.

In regard to Mr. Taylor's remarks, when models of submarines are towed at speeds far above those for which they are suited they may become erratic in their movements. Under such conditions wave-making would become abnormal, and if longitudinal stability is lacking the model may show a tendency to go down by the head or to dive. I believe that many cases where existing submarines, when running on the surface, have shown a tendency to change trim suddenly can be explained by the presence of loose water in partially filled ballast tanks. The great danger of running under such conditions must be empha-

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sized. I am very much obliged for the points which Mr. Taylor brought out in connection with submarine proportion, and hope that model tank experiments can be used in that direction. I realize the value which model tank experiments will be in future developments. I regret I cannot give further data in regard to these boats, but would prefer not to mention any dimensions whatever, as it brings up questions in connection with which I do not feel at liberty to speak.

Spencer Miller: I move a vote of thanks to the author of this paper.

MOTOR BOATS FOR NAVAL SERVICE.

In the absence of Naval Constructor L. S. Adams his paper entitled "Motor Boats for Naval Service" was read by D. H. Cox. As this is a highly important paper it will be given in full in the REVIEW later.

DISCUSSION.

W. P. Stephens: I notice on page 3 the writer says: "As regards the reliability of the gasoline engine compared to the steam engine, it appears that the prevailing opinion on this subject which is adverse to the gasoline engine, is based on experience with automobiles and with the thousands of small gasoline boats in use generally for both pleasure and commercial purposes." I will say that the automobile engines are put to the severest test, the bonnets being sealed and the cars running for 100 miles without any one touching the engine other than the adjustments which are provided, the manipulation of the admission, and all that. The automobile engine today seems to prove the reliability as well as the flexibility of the modern gasoline engine. It is the same thing in regard to gasoline launches. Five or six years ago automobiles were an experiment on the part of manufacturers and they were turned into the hands of persons without any knowledge of them, and they were unreliable. That day seems to have gone by, and the same thing is true largely with the launch engine. In that connection on page 4, the writer "maintains that in the hands of a man especially educated for the work, a gasoline engine is sufficiently reliable for naval use." As to the education for that work, the experience seems to be in yachting that a man need not be a machinist, engineer or electrician to run a gasoline engine, many men who run them are Swedish sailors without any previous knowledge of machinery of any kind, many of them seem to develop a remarkable ability in the handling of gasoline engines, and it is really remarkable, when you consider how little they know of the theory of the engine or the particular work which the engine performs. I think that is a strong demonstration of the possibility of these engines being handled by the men in the navy, as they are so successfully handled on the yachts which are in use today. There is no training in the handling of a gasoline engine that would be considered necessary if a man was going to run a steam engine. There is one other point, and that is the saving of space. This varies with the different makes of engine, and I will quote the author of the paper on this point who says: "This varies with different makes of engines, but may be safely counted upon as being 20 to 25 per cent in length." I thing the saving in space is much greater than 25 per cent in length. When you come to take out the steam plant and boiler and bunkers, and possibly the water tanks, and replace them by simply the gasoline engine, because the gasoline tank goes in a space not utilized for other purposes, you get rid of a very large proportion of the space, I should say you utilize one-third of the space which is necessary for the steam plant, depending, of course, on the size of the boat.

F. L. DuBosque: From the discussion we have heard from the different commanders of naval vessels it seems to be the consensus of opinion that motor boats are desirable in naval service, and there seems to be only one answer to the paper prepared by Mr. Adams, which he endeavors to bring out. I notice we have three papers on practically the same subject for discussion this afternoon. I also notice that the room is primed with gasoline experts. I have read all three of the papers, and they all seem to trend in one direction, and I suggest whether or not it would be practicable to have the three papers read and discussed at one time. I am sure that a great deal of the discussion on each paper will refer to the others.

R. C. Monteagle: Gasoline motors for the propulsion of naval boats may seem to be attractive, but I think that they appeal to those only who do not realize the extreme danger of gasoline. It would be interesting to know in detail how the author of this paper arrived at his belief that a lighted cigar cannot cause an explosion, even if brought in contact with an explosive mixture of gasoline vapor and air. A mixture of gasoline vapor and air at the proper density requires only the application of a lighted cigar with the ash removed to ignite it, hence explosion may result therefrom at any time the conditions may be favorable. An experiment of this character was made at various times to my knowledge as follows: A kerosene can was filled with gasoline and placed in the open air, a lighted cigar was then applied to the opening which was about seven-eighths of an in. in diameter. Ignition was obtained immediately, the vapor burning with a blue flame. This flame was blown out and ignited again without damage. If it had been possible to admit air into the can in sufficient quantity an explosion would have occurred without doubt. Where ignition may be obtained, explosion may be a natural sequence, the conditions being favorable. It is true that a slight variation from the critical density, plus or minus, may avoid a catastrophe. But herein lies its subtle danger. At wide variance with the author's next statement the explosive effect of gasoline vapor and air in a closed chamber has been found to cease at a ratio of about 1 to 16 in volume. A saturated mixture of air and gasoline vapor in equal volume will not explode, while the most intense explosive effect is realized from a mixture of one part vapor to nine parts of air. That is, therefore, a possible gamut of explosive mixtures of very wide range. Fire insurance companies testify to the danger of gasoline by prohibiting its storage in dwelling houses, even in minute quantities. To the question, can gasoline be carried with safety on war ships, I should answer, no, as the danger from leaky joints is too great. But should the decision be arrived at to carry gasoline, the system of double copper tanks and double copper pipe lines would be the least dangerous. The inner tank and pipe line carrying the gasoline, the space between the inner and outer tank and pipes being constantly flooded with water, the pipes being as short as possible, and having a minimum number of joints, also being kept as far below the water line as possible.

I do not agree with the remark of the commander-in-chief of the north Atlantic fleet that there are many more explosives on board a warship worse than gasoline, and hence there there should be no objection to carrying one more. The destructive effect of an explosion of gasoline is certainly not so great as that of gunpowder, but gasoline is much more volatile and in contact with air becomes a dangerous explosive.

C. H. Crane: I have listened to the

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criticisms of the last speaker with a good deal of interest, as the problem has presented itself to us in a similar form. The carrying of gasoline inside of any vessel is undoubtedly attended with great danger. The carrying of gasoline in launches and on deck is permitted by the insurance companies, without any increased premium rate, and that is evidence of the fact they do not consider it dangerous. The method prescribed in carrying gasoline at sea is that it shall be carried on deck in steel drums, and the boat may carry in their own bunkers what is necessary for running, but the minute gasoline is put below decks, the insurance is at once vitiated. That reduces the probability of damage, and avoids an increase of danger, in case of fire occurring on the vessel. Of course, gasoline in a steel drum will explode just as any other liquid in a steel drum will explode, provided you heat it hot enough, and these drums have been so arranged that in case of some accident they can be immediately rolled overboard, and the boats containing the gasoline can be put overboard and put out of danger of making trouble.

What the writer of the paper has said about the gasoline engine I think needs some further enthusiastic comment. The gasoline engine is one of the hardiest pieces of machinery I have ever had anything to do with. In the first place, it is a single acting engine, the wearing of the main journals can go on to an extent where there is fully a quarter of an inch play, without the engine being put out of service. There are only two delicate features, the carburation and the ignition, and these features in the hands of a man familiar with them are very easily taken care of and troubles rectified. The great objection we find in the use on yachts of gasoline launches is the fact that no one on board seems to know how to manage them, and we have to carry an extra man to take care of these two features, and that is a thing, I think, which is simply a matter of education and the time will come when the engineer will feel that sort of thing is of sufficient interest to him to understand it. I think that will be one of the greatest difficulties which any government ship or merchant ship would have in the use of such launches.

W. F. Palmer: It so happens that I have a fleet of vessels, using 15 of those naphtha boats. I designed them all. They are 28-ft. boats, and have engines of various makes up to 10 or 12 horsepower. I at first thought these boats were very dangerous and refused to have naphtha carried either in the tanks or drums, but in a period of seven years we have never had a single accident. We have carried naphtha in cargoes and brought in as much as 4,000 tons, 19,000 barrels, and I think the foreign governments which supervised the handling of naphtha, have an idea more than any one else that the naphtha is dangerous. We have found from first to last not a single trouble from one of the boats or engines, except this—that the mate goes ashore and the boat always gets out of kilter, so he cannot return, but the next morning the boat runs beautifully. We carry these supplies of naphtha and drums on deck, and make the tanks to carry about 54 gallons, and we buy the gasoline in 51 gallon barrels, at the barrel prices, and we get the gasoline at the cheapest possible cost.

I think so far as these big coastwise vessels are concerned, the next ten years will show, not only every vessel with one good big naphtha launch, but with a second one also. We had one experience of taking a crew off a stranded vessel, when small streamers could barely live in the sea, and these boats rode the waves beautifully. That is our experience as to naphtha boats.

R. H. Watt: As some doubt seems to have arisen with regard to the use of gasoline engines, as to the reliability of gasoline engines, I will say that within a week I rode from Norfolk to the Jamestown exposition with Mr. Adams in his automobile at speed from 30 to 38 miles an hour, and there is absolutely no question as to his belief in the reliability of gasoline engines. As to the matter of speed, I would prefer to drive with Mr. Adams at a speed of 38 miles an hour than with an amateur at speeds of eight or ten miles an hour.

The president: The thanks of the society are due to Mr. Adams for this paper, and I hereby tender them to him.

The chair will remark in connection with what Mr. DeBosque said regarding the reading of the papers all at one time and discussing them *en bloc*, that involves editorial difficulties which are insuperable. It is to be regretted that neither the author of the paper, nor the naval officers who have commented on this paper, have given us any information as to the probable addition to the fighting efficiency which might be created by the use of gasoline boats, and whether the use of these boats has any advantage corresponding at all to the unquestionable enormous risk in time of action of carrying gasoline in the battleships or gasoline vessels.

COMMUNICATED DISCUSSION.

Com. Wm. P. White, United States navy: The motor boat seems admirably adapted to fill our need for a speedier and more seaworthy craft for picket duty than our present steam launch; but we should not take the risks involved in stowing and handling so dangerous and inflammable material as gasoline on shipboard, but use at once denatured alcohol even in engines designed for gasoline, notwithstanding the loss of efficiency. Recent experiment with carbide in connection with alcohol vapor has demonstrated that the motor is as reliable as when using gasoline, and a lower grade and less expensive spirit may be used. For starting motors, compressed air is used in the latest models of motor cars, and may be used in motor boats. Compressed air will be needed for the whistle.

It is not desirable to install motors in cutters, whaleboats, and smaller craft. When these boats are used, their crews should receive the benefits of the physical exercise and practice in handling oars. The one exception is the captain's gig, which, having to be used for visits of ceremony, is apt to be needed during drill periods when it is not convenient to spare the crew.

In the design of the boats certain changes are desirable in the accepted arrangement for standard steam boats.

(a) The steering station should be abaft the engine compartment; the coxswain so placed to see all around the horizon, at all times his head above the canopies. He will be better protected in rough weather than with the wheel forward, where now he is frequently drenched, and where a canopy effectually shuts off all view abaft the beam.

(b) The tiller and wheel ropes should be above the deck, for the better support of the rudder, that the wheel ropes may be always under observation, and that the stern compartment of the boat be made water tight.

(c) The ladder, if one be needed, should be in the after end of the stern sheets; ingress and egress be made from the after end of the boat, as this may the easier be held alongside a gangway or float in rough weather. The canopy for the stern sheets should always be open aft.

(d) Washboards about all openings should be amply high to keep out the wash in rough weather.

(e) Fuel tanks should be two in

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number, one forward and one aft—the latter for reserve supply.

(f) Provision for a stern light should be made.

(g) Acetylene gas should replace the inefficient lighting by lard oil, especially for running lights.

Capt. Seaton Schroeder, United States navy: The subject of motor boats for naval service is, of course, one of peculiar interest to naval men. The presentation of a paper upon the subject before this society is a matter upon which the navy may congratulate itself—all the more so from consideration of the excellence of Mr. Adams' exposition of the subject.

Anyone plodding along in one of our steam launches, who has occasion to observe a motor boat passing, is unfailingly impressed with the difference in the service furnished by the two—more especially, at first glance, in the carrying power of the latter, due, as is pointed out, to the greatly reduced weight and volume of its machinery. The almost irresistible tendency is to exclaim "why cannot we have them in the navy?" The sight of one motor whale-boat in the fleet lately has undoubtedly emphasized this thought. Of course the advantages inherent in explosive engines are many besides that of reduced weight and bulk; all of which are well pointed out in the paper under discussion. It is perhaps safe to say that there is a very general appreciation of the advantages possessed by the motor boat for naval service; it may be that there is also a like appreciation of the difficulties attending its introduction, but these are, I think, less generously cited, which is a very fortunate attitude, tending to facilitate rather than to retard progress.

There is a feature in the problem, which has not been touched upon by the essayist but which appeals to me as creating the most serious condition with which we have to reckon. I allude to the inconvenience of having a ship's boats use a fuel different from that used by the ship herself. If, having been in action and having let the gasoline or alcohol run overboard for that reason, or from having exhausted the supply in any other way, a ship's power boats should be inoperative, it might be a serious inconvenience. t is true that from the lightness of explosive engines, a boat normally propelled by them would still be available under oars; but the mobility and value of the boat power of the ship would be seriously affected. It is also true that colliers or other supply ships could be fitted to carry gasoline or alcohol; and this furnishes a partial answer to the difficulty. As a matter of fact, a more or less satisfactory answer can be found to almost any difficulty. But considering all the phases of naval service *in war,* which should be the only situation considered, I apprehend that the feature which I have mentioned is of more serious import than the technical questions of reliability, danger from fire, etc. However much we may enjoy the jokes at the expense of automobilists who find themselves stranded by the roadside, probably no one will seriously urge unreliability as an argument against the adoption of explosive engines for navy boats. It is not so many years since, upon the occasion of a derangement of a small ship's machinery, her captain remarked to me that sails were a much more reliable method of propulsion; and I thought then, as I still think now, that at that time he was not far from wrong. But steam engines have improved since then. And explosive engines will improve now; and I think that the question of adopting them should not be delayed on that score.

In the matter of danger from fire, a very important factor is introduced in the brief suggestion that "the development of a satisfactory and efficient explosive alcohol engine is near at hand." This is a development which seems to be worth waiting for; and I should counsel waiting for it—at all events, for a while. The property possessed by alcohol of mixing with water and of ceasing to burn when diluted beyond a certain point is one of inestimable value when compared with the property possessed by gasoline of continuing to burn while floating upon water.

From the point of view of simply a user of boats, therefore, I beg to suggest that in the final determination of the question as to whether or not it is advisable to introduce motor boats generally in the naval service, the essential point to be decided is whether or not the certainty of having a supply of the explosive fuel on hand is sufficient to warrant facing the possible danger of finding ourselves without power boats inoperative. And this suggests the possible propriety of putting motor boats only in ships that remain in company with the fleet and its supply vessels; small cruisers and gunboats or other vessels liable to be employed on detached duty would perhaps better retain boats using the same fuel as the ships themselves. A beginning could be made by substituting one motor launch for one steam launch in each battleship and large cruiser that carries two or more steamers. To simply fit one of their pulling boats with a motor would evade the question; it would simply be an admitted convenience and would tend to place boatsmanship still further back in the category of obsolescent arts; but a sure way of determining the advisability of adopting motor boats to the exclusion of steam boats is to so introduce them that if they fail in any way the pinch will be felt.

One more suggestion from the standpoint of the user of boats. The expression "motor boat" is popularly associated with ideas of speed and sport. We do not want anything of that kind for general purposes in the navy. What we need is boats of about the present type with good wholesome towing propellers, able to carry a good load and tow a number of other loaded boats. There is no objection to speed, of course; but it should be wholly subordinated to seaworthiness and carrying and towing capacity.

Rear Admiral Chas. M. Thomas, United States navy: 1. I have read with much interest the excellent paper on "Motor Boats for Naval Service," by Naval Constructor L. S. Adams, United States navy, and it gives me pleasure to state that, in the main, I agree with his conclusions and recommendations.

2. The contemplated plan of carrying gasoline in copper tanks located in the trimming tanks of the vessel, is an excellent suggestion, and I believe it to be entirely practicable, and the safest method that comes to my mind, or that I have yet heard proposed.

3. The advantages and disadvantages of the general adoption of the motor boat for naval use are fairly and fully summarized in this admirable paper, and I agree with the author that the former outweigh the latter very materially.

4. The navy has been exceedingly conservative upon the subject of change of power for its small boats, and, in my opinion, too much so, and I believe the time has come when extensive experiments with the motor boat should be inaugurated, and I hope soon to see at least one boat of this class upon each battleship, to be given an exhaustive trial, and fully reported upon in comparison with the steamer, under all circumstances of wind and sea, and carrying requirements.

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Lieut. F. T. Evans, United States navy: As it will be impossible for me to be present at the meeting when the paper by Naval Constructor L. S. Adams, United States navy, "Motor Boats for Naval Service" is read, I write to say that I heartily endorse Mr. Adams' paper. The subject of explosive engines for our small boats has interested me for several years, and it was at my request that the Dart was built and equipped. During the year or more that I had charge of her, the engine did not once, *per se,* refuse to start, nor did it ever give any trouble while running. Once, the presence of water in the cylinders, due to a cracked cylinder, made starting difficult, and once, a flap valve in the carbureter delayed the starting. The boat ran at high maintained speeds in all sorts of weather. The 40-ft. barge referred to by Mr. Adams was built at my suggestion, but her installation of a jump spark engine has never given complete satisfaction. This boat is peculiar in that at slow speed she will ship quantities of water while at full speed in similar weather she takes none. This was fully demonstrated in New York harbor where she drowned her engine while slowed down, but after being dried out, ran from Twenty-third street, East river, to Tompkinsville, in less than half an hour.

The gasoline installation in whaleboats I consider very good in theory, but as yet I think the right engine has not been used. These boats are such good sea boats that their design should not be changed, except after most mature deliberation.

I have seen something of gasoline dories on board ships, having been part owner of two on board the Louisiana. The first was bought second-hand in Provincetown, Mass., was about 26 ft. over all, built by the E. Gerry Emmons Corporation, Swampscott, Mass, and equipped with a 6½-H. P. Lathrop engine. She was an excellent boat. The second was built by the same company for the officers, and similarly equipped. Mr. Adams seems to think that these boats cannot be driven to windward, but in this he is mistaken, for the Cape Cod fishermen drive them anywhere. The boats, however, are fitted with a tent canopy, which keeps the water out, and the Lathrop engine being a strong make and break can stand the racket.

If the officers of the navy would be satisfied with moderate speed in motor boats, I feel confident that it would hasten the installation of interior combustion engines whose ultimate acceptance I feel is assured.

I regret that time fails me for a longer discussion.

Lieut. Com'dr C. Theo. Vogelsung, United States navy: Replying to the invitation of the Society of Naval Architects and Marine Engineers to discuss the paper on "Motor Boats for Naval Service" to be read at the forthcoming meeting of that society, I beg to submit the following remarks:

With regard to the storage of gasoline, it would seem that all things considered it would be better to have it stored in suitable tanks on the weather deck. While this would undoubtedly be a menace to a ship in time of action, it does not seem to be unreasonable to provide that when an engagement is probable and the ship is finally and completely cleared for action, the tank be emptied and the contents delivered overboard. If your vessel survives the conflict, it would not be difficult to obtain more gasoline, and if you did not survive the loss would not be felt.

On the general subject of the advisability of the adoption of the gasoline or other explosive engine for the service in place of the steam engines now in use in small boats, I am in hearty accord with the writer.

I do not believe that sufficiently satisfactory results would be obtained by the substitution of gasoline engines for steam engines in the launches, as at present constructed, to warrant such change. It would be better to begin at once upon a new design of boat constructed especially for service with gasoline engines, and let them be introduced on board ship gradually for a time, when they would be brought into competition with the present standard navy steam cutters and the advantages or disadvantages of the new design become evident.

What is needed in boats in service nowadays is speed, seaworthiness and carrying capacity, and it is my opinion that these requisites can be obtained in greater measure by using gasoline or other explosive engines than with steam power in boats of equal size, and at the same time save in weight, which is an important collateral factor.

In the matter of what might be termed the freight and liberty boats, such as sailing launches and large cutters, it would be a positive advantage to have them equipped with a small power gasoline engine, say 6 H. P., that would be ready for use at a moment's notice and be capable of being handled by three men, with all the other space available for passengers or freight, a condition not obtained as at present equipped, except when being towed.

Power boats are now being used at life saving stations, replacing the manpower life boats. This is a distinct indication of their trustworthiness and seaworthiness, and it suggests the employment of such boats in the naval service for a like purpose.

Capt. A. C. Dillingham, United States navy: I have read with much interest the paper, "Motor Bots for the Naval Service," by Naval Constructor Adams, U. S. N., and respectfully submit to your society a few ideas that have occurred to me in going over Mr. Adams' paper.

I do not believe that there is any prejudice in the navy on the part of naval officers against carrying gasoline, or anything else that will add to the efficiency of a fighting ship, but the trouble is more on account of the organization. It is very difficult to make an innovation, and in this particular case, motor boats, though I think naval officers are familiar with their possibilities, naval constructors have not yet presented a design suitable from a sailorman's view point, to meet the conditions in the navy.

One of the questions under discussion is, if it is desirable to use gasoline engines for boats in the navy instead of steam, is it advisable to carry gasoline aboard a man-o'-war? The fact that the commander-in-chief of the Atlantic fleet would not object to carrying one more explosive aboard his ships, is not a great argument as to the safety in carrying the liquid, but the experience with gasoline aboard our submarines, as cited by the author, is a strong argument for carrying the liquid, and it would seem if the same attention to precautions against accident is paid to gasoline that is given to other explosives aboard ship, the risk would, at least, be reduced to a minimum.

It becomes a question in considering the adoption of gasoline engines for boats in the service, whether or not the advantages to be gained by their use is worth the risk in carrying the liquid. The radius of cruising with a gasoline boat is confined to the limit of the supply, so if motor boats are adopted, it would be necessary to carry a large amount of gasoline, and this suggests the advantage of a steamer, which is not mentioned by the author; that the steamer is not confined to coal, but may use anything that will burn or generate steam, and we frequently have had

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occasion in the navy in service, where the steamer was obliged to burn wood after the coal was exhausted, and under conditions where if it had been a gasoline boat it would have been impossible to get the gasoline. This is a point in favor of the steamer and an objection to the gasoline boat. This condition frequently occurs ashore, and it was only the other day that I was cruising in an automobile, when it was found that the gasoline supply was exhausted, and we were 25 miles from a gasoline tank—probably bad management—but it illustrates the point that I make.

With the experience in having gasoline aboard submarine boats, I believe that the service would feel that the risk is very small with gasoline carried as suggested by the author and without interfering with the uses of trimming tanks.

The almost universal adoption of gasoline engines in boats from the capes of Virginia to Nova Scotia would indicate that this power is accepted as a means of saving time and labor, and anything that will accomplish this end in the fleet will directly, or indirectly, add to the efficiency of the fleet where a battleship is a superb example of mechanical power and calls for the application of time and labor saving devices.

It will be acknowledged that almost unaccountable and serious accidents have occurred with the use of gasoline and, like many high explosives, conditions arise in the most unaccountable way that produce explosions, so that I think it is perfectly natural that naval officers, who cruise in vessels and have the responsibility for the safety of those vessels, should require that they be well convinced of the element of safety.

With the necessity of reducing the number of boats carried by a fighting ship to the minimum for service conditions, gasoline presents the great advantage of decreasing the weight in boats thereby increasing the carrying capacity.

The absence of flame from the smoke pipe of a gasoline boat is a strong argument for its use in picket boats, if naval constructors can present a design that will compare favorably with the present service steamer in seagoing qualities. The picket boat should possess high speed, be noiseless and invisible, and should be able to start and back instantly. The picket boat must have good sea or weather qualities, and if a design can be presented to meet these conditions with a gasoline motor, it would be ideal.

The author says: "The development of the explosive gasoline engine has not reached the stage when it is evident that this engine is applicable to the higher powers necessary for larger vessels," so that we are confined, as far as the navy is concerned, to the small boats carried aboard ship.

If we adopt the gasoline engine aboard the man-o'-war, it will be necessary to have aboard each ship one steamer for the reasons that I have mentioned above, for it may be necessary to use a boat where it is impossible to get gasoline.

I am familiar with the designs of gasoline boats that have been furnished the navy, and these designs are not satisfactory; they are too light, and with the serious vibrations at full speed the boat is racked to pieces, and they do not possess the seagoing qualities to meet the conditions of our service. The sea tests given these boats in Hampton Roads (I was present during these tests) amount to but very little compared with the tests in actual service that our present steam launches have successfully passed through. Recently in the Rio De La Plata, during a pampero and on the north coast of Santo Domingo, during a norther, I was obliged to cruise with a service steamer under sea conditions that compelled several foreign men-o'-war that were present to keep their boats at the davits, and under such conditions it is not speed that is necessary, but the design. Very frequently are steamers called upon to meet such conditions, and will be in a fleet of battleships, particularly in time of war on the 20 fathom curve.

With the present development of the gasoline engine it could be applied to great advantage to life boats that will probably always be carried on a man-o'-war. For instance, I think the two-cycle motor installed in a life boat would add tremendously to its efficiency. In this case the noise of the exhaust would be of great benefit in encouraging the man overboard, as he would know that relief was coming, and the boat could be more easily located at night and in thick weather from a ship; it would also obviate the frequent long delays in getting the oars out and getting away from the ship, and would expose fewer men to the danger of being lost in service.

Again, a speedy motor boat, such as the Dart for instance, should be attached to each vessel to perform the divisional guard boat duty. This guard boat service is very important in fleet, and in my opinion, deplorably inefficient, but this could be remedied by the use of a boat similar to the Dart.

To conclude, I am of the opinion that Naval Constructor Adams is correct in his ideas of the advantages to be gained by the use of gasoline motor boats, and I believe that as soon as the naval constructors will present a design of motor boat that will meet service conditions it will have the hearty support of seagoing naval officers.

Capt. John Hubbard, United States navy: Mr. Adams has so fully covered the subject of his paper as to leave few, if any, new points to be brought out. I agree substantially with all that he says, and, disclaiming any expert knowledge of the subject of motors, shall confine my remarks to the question of the desirability or the necessity of changing from the present type of power boats supplied to the vessels of the navy.

There is no doubt in my mind as to the necessity of equipping our battleships with power boats that shall combine in the highest degree practicable the following qualities:

(a) Largest dimensions within stowage limits.

(b) The greatest carrying capacity consistent with the limits of dimensions.

(c) The maximum towing efficiency consistent with carrying capacity and efficient speed.

(d) Proper stability and buoyancy under all conditions of load, and such dryness as possible.

(e) Good structural and a fair degree of local strength—sufficient to stand the rough usage incident to untrained and clumsy handling.

It is my belief that these qualities can be combined to a much higher degree in a gasoline motor boat than with a steam installation. There can be no objection to carrying gasoline during time of peace, and in time of war there would probably be with the fleet, on the only occasion when a power boat of any kind could be required, one or more fleet auxiliaries which could furnish gasoline as needed, if not considered advisable to carry a small amount in each ship in the forward trimming tanks, as the writer suggests, or, better I think, in the double bottoms outside of engine spaces.

The only possible objection that I can see that can be fairly raised against the gasoline motor boat is that of difficulty in operating, and this I believe to be largely a question of good material in the first place, supplemented by proper care and intelli-

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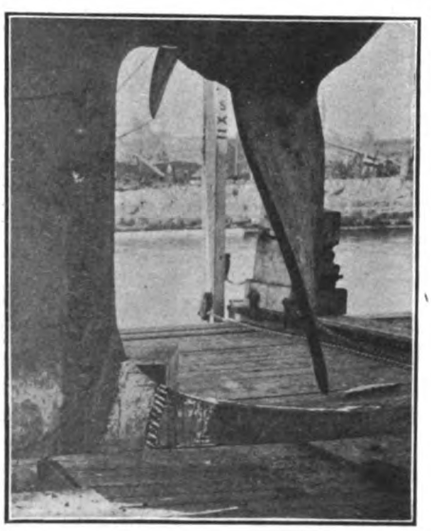
gent handling. That both of these is obtainable is daily demonstrated outside the navy, and there is absolutely no valid reason why the service should not be capable of achieving the same. It is, in my opinion, merely a question of time when the motor boat will be adopted for the navy, and the sooner this inevitable is accomplished it seems to me the better, but it would be, I think, a great mistake if we should commence with makeshifts of any kind, such as fitting motors to our present steamers, although admitting the enormous advantage of installing small "kickers" in our present sailing launches.

THERMIT REPAIR ON STERN POST.

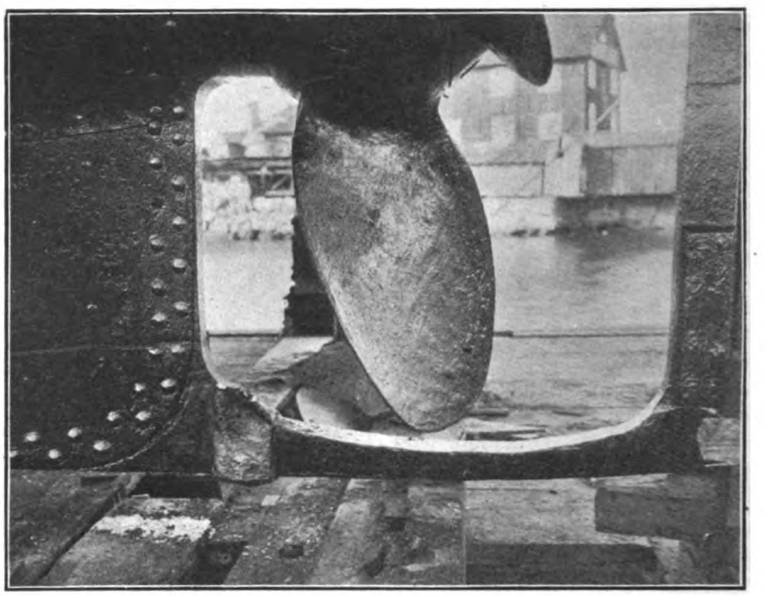
An interesting repair was recently effected at the yards of the New London Marine Iron Works, New London, Conn., on the stern post of the steamer General Nathaniel Greene, belonging to the quartermaster's department of the army.

The General Nathaniel Greene is 368 tons register, and 165 ft. in length, and the stern post was approximately 4¼ by 8¼ in. in section at the point of fracture. It will be seen, therefore, that the section was a fairly large one to weld, and the fact that by the Thermit process the repair was effected in only nine hours, including the time consumed in constructing the mold, is proof of the great value of this process in marine work.

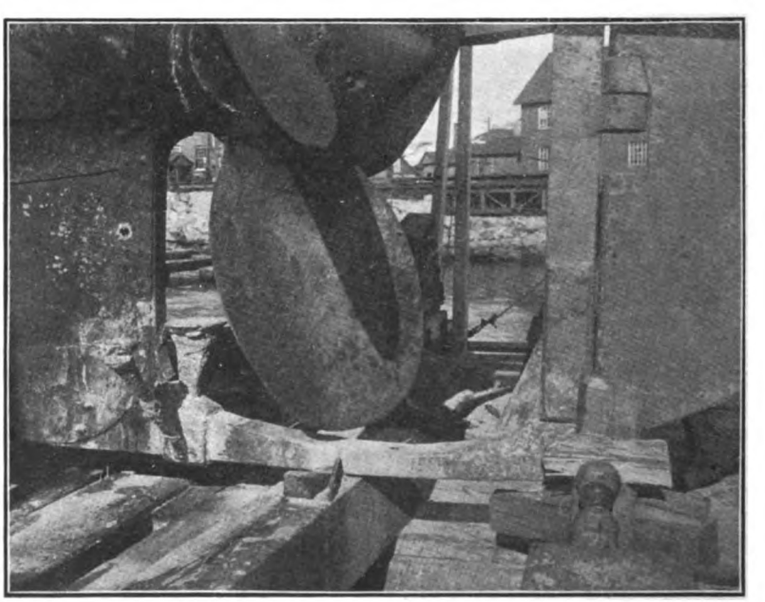


FRACTURE IN STERN POST OPENED UP AS A PRELIMINARY TO WELDING.

On inspection it was found that the shoe, or skeg, had been broken off about 6 in. from the center line of the stern post, and the shoe itself pushed fully 6 in. out of line. In making the repair, the first operation was to open up the fracture by drilling a series of 1-in. holes along the line of the break, in order to allow for the free flow of Thermit steel. When this had been accomplished, the shoe was forced back into place by means of jacks, and firmly secured. A matrix of wax was then shaped about the fracture, being formed into a collar 7 in. wide and 1 in. thick, the idea being to contruct a pattern in this manner which could afterwards be melted out when molding sand had been packed around it. It was, of course, necessary to provide for a gate and riser, and patterns for these were constructed of wood. Care was taken in their design, however, to lead the molten Thermit steel to the lowest point of the mold and then permit it to rise up and around the parts to be welded into a large riser, the principle of Thermit welding being to secure a perfect amalgamation of Thermit steel with the steel of the broken sections. Thermit steel, being twice as hot as ordinary steel, has the property of dissolving the metal with which it comes in contact and amalgamating with it to produce a homeogeneous mass.



FINISHED WELD ON STERN POST WITH GATE AND RISER REMOVED.



FINISHED WELD ON STERN POST SHOWING METAL ON GATE AND RISER IMMEDIATELY AFTER REMOVAL OF MOLD BOX.

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With the wax and other patterns in position, a sheet iron mold box was placed around them and packed with a mixture of 1-3 fire clay, 1-3 ground fire brick, and 1-3 fire sand, provisions having been made for leaving a small hole at the bottom of the mold to permit of the escape of the heated wax. This opening was also used as a means of preheating the broken sections previous to pouring the Thermit steel, the flame of a powerful gasoline torch being directed into it and so permitting of the hot gases passing directly over the fractured parts, and so out through the riser.

While the parts were being heated a crucible containing 260 lbs. of Thermit, 50 lbs. of soft mild steel punchings and 5 lbs. of carbonless metallic manganese was placed in position above the pouring gate, and, as soon as the parts to be welded had been brought to a red heat (in about two hours), the hole at the bottom was plugged up with a dry sand core, and the Thermit in the crucible ignited. The ensuing chemical reaction lasted about half a minute, then the superheated thermal steel was tapped into the hole, where it filled the space originally occupied by the wax.

The mold box was allowed to stay in position over night, in order to permit of a thorough annealing of the weld. Upon its removal in the morning, it was found that perfect amalgamation had occurred between the Thermit steel and the metal of the stern post, much to the satisfaction of the officials of the boat and of the ship yard.

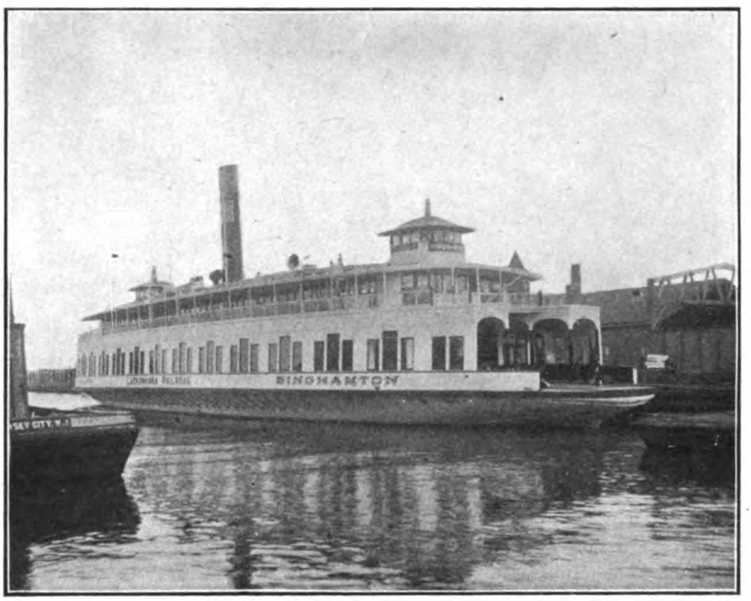
The weld was performed under the personal direction of G. E. Pellissier, engineer of the Goldschmidt Thermit Co. of 90 West street, New York City, and H. C. Fletcher, of the same company.

The Atlantic Works, East Boston, Mass., will soon launch the steamboat Betty Alden for the Nantasket Steamboat Co. She will be launched by Miss Betty Alden, a lineal descendant of John and Priscilla Alden, whose names have been perpetuated in Longfellow's poem.

The Hudson Bay Co. has let the contract for the construction of two stern-wheel steamers for its Skeena river service. The hulls will be built by Alex Watson, Victoria, B. C., and the Polson Iron Works, Toronto, Ont., will build the machinery. The vessels will cost about $80,000.

LACKAWANNA TERMINAL IN NEW YORK.

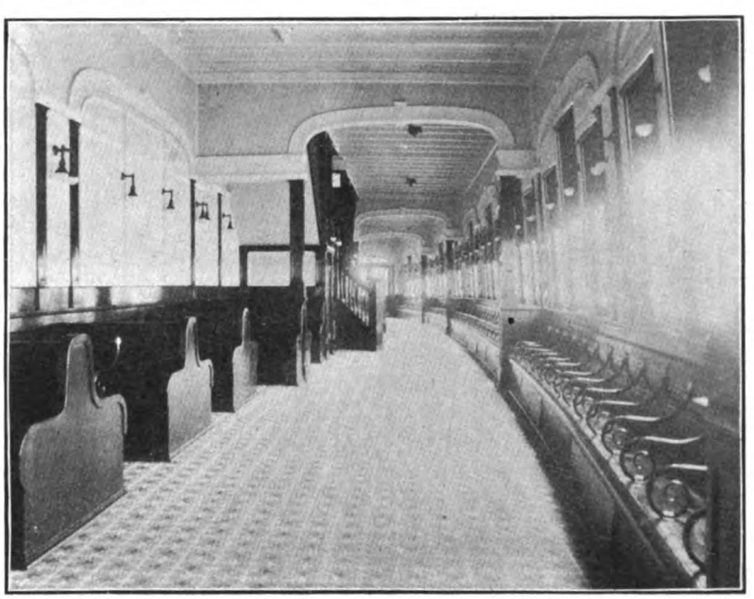
The exterior lighting of the new Lackawanna terminal, at Hoboken, will include some strikingly novel features, as well as good examples of signs and outline work. The large sign, Lackawanna Railroad, on the waterfront of the building, is built of letters 9 ft. high. The arches of the ferry slips are outlined with incandescent lamps, the whole forming a striking picture from the river.



TYPE OF LACKAWANNA FERRY IN SERVICE ON NORTH RIVER, NEW YORK.

The most impressive feature of the exterior of the station, however, and one which will make the tower the most conspicuous object at night on the entire North River front, will be a cluster of 49 arc lamps, arranged in series within a single globe 6 ft. in diameter, each arc consuming 16 amperes at 2,300 volts. It is estimated that a candle-power of 1,500,000 will be reached.

This will unquestionably be the most powerful light ever produced from a single fixture, and from its position on the upper part of the tower, will illuminate a considerable stretch of the Hudson river. Besides being a most impressive spectacle, this experiment will prove of no little commercial value in demonstrating the possibility of lighting large



LOWER CABIN OF LACKAWANNA FERRYBOAT BINGHAMTON.

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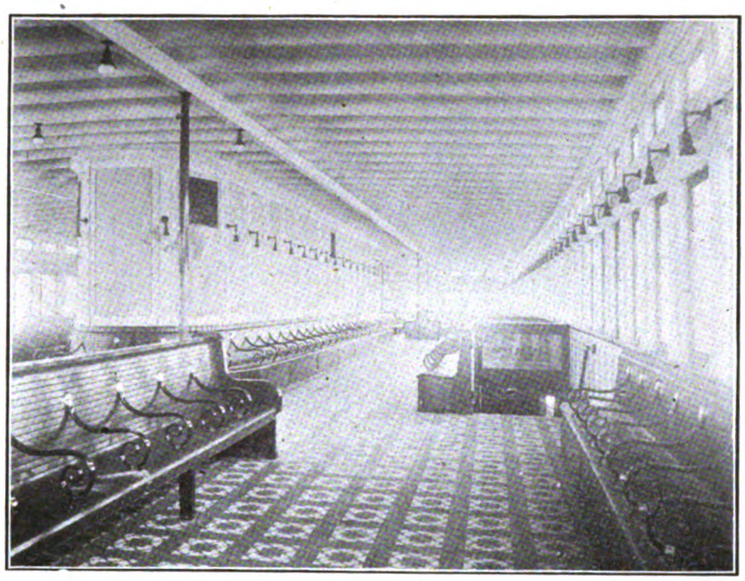


UPPER CABIN OF LACKAWANNA FERRYBOAT BINGHAMTON.

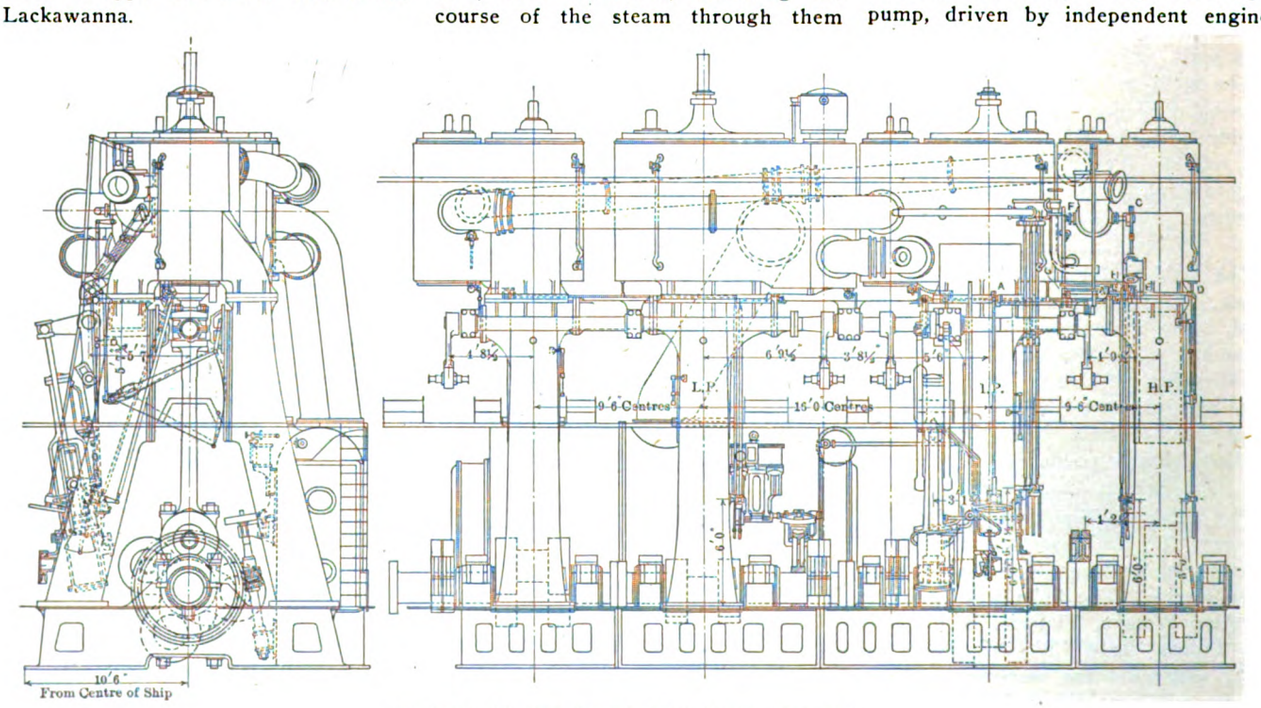
open spaces with exceedingly high candle-power placed at proportionately great distance above the illumined surface.

The Lackawanna railroad has now a fleet of 16 craft navigating the waters of New York harbor, the latest addition to the service being the palatial ferry Lackawanna, which recently left the yard of her builders, Newport News Ship Building & Dry Dock Co., coming round to New York under her own steam.

The accompanying photographs are views of the type of ferry in service on the North River, and interior of upper and lower deck of the Lackawanna.

THE ENGINES OF THE ADRIATIC.

Messrs. Harland & Wolff, Belfast, have supplied us with the drawing, here reproduced, of the engines of the Adriatic, the latest addition to the White Star fleet. The Adriatic is 725 ft. 6 in. long, 75 ft. 6 in. broad, 57 ft. 6 in. deep, and her loaded displacement is 40,000 tons. To give her an average speed of 18 knots, she is fitted with two independent sets of quadruple-expansion engines. These engines have high pressure, second intermediate pressure, low pressure and first intermediate pressure cylinders, their diameters, following the course of the steam through them being 35½ in. for high pressure, 51 in. for first intermediate, 73½ for second ditto, and 104 in. for low pressure, the piston strokes of all being 5 ft. 3 in., each piston driving a separate crank. The engines, which are arranged on the "balance" principle to minimize vibration on the ship, drives two screw propellers over 20 ft. in diameter. The cylinders are made of tooth cast iron, and are each fitted with liners, the pistons being cast steel, with forged steel piston rods. As shown in the illustration, the two forward cylinders of the set are each supported by two cast metal columns, directly carried by the engine bed plate, while the two aftermost cylinders are jointly supported by similar columns in front, and by the top of the condenser behind, the condenser in its turn being seated on the bed plate, which is practically formed of four castings bolted together, and containing the crank shaft bearing brasses, the crank shaft, which is of steel, running on them being 20¼ in. in diameter. The side valves which are of the piston type for the high-pressure cylinders are all actuated, as shown in the illustration by double eccentrics and link motion, suitable gear being provided on the reversing levers to enable each valve to be linked up independently as required, the reversing engine being attached, as shown, to one of the cylinder supporting columns, and the turning engine to the front side of the surface condenser. The cooling water for the condenser is delivered to it by a large centrifugal pump, driven by independent engine,



ENGINES OF THE WHITE STAR LINER ADRIATIC.

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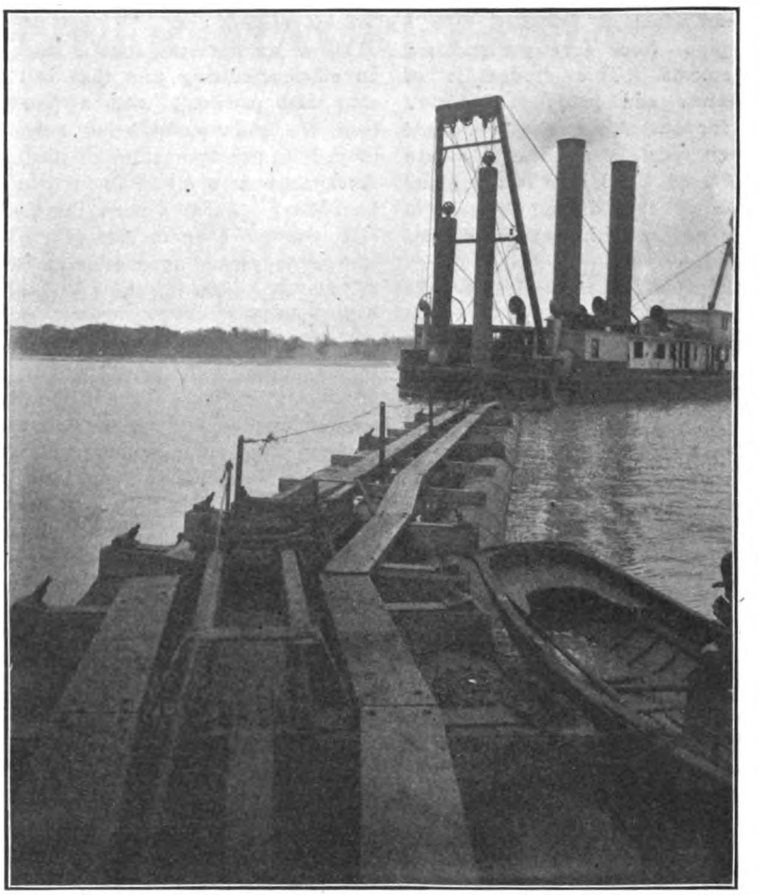
while the main air pumps, which are placed behind the condenser, and are of the vertical type, are also worked by their own engines. The connection between the low-pressure cylinder exhaust and the condenser is as shown, effected by one large function pipe. Steam for the main engine of the ship is supplied by twelve ordinary cylindrical multitubular boilers, designed to work at a pressure of 210 lbs. per square inch, each having a large heating and fire grate surface. The smoke and waste gases are carried off by two funnels, each about 130 ft. high above the level of the fire bars. For the various services required throughout the ship, there are, in addition to the main propelling engines, 24 auxiliary engines.

A NEW HYDRAULIC DREDGE.

The dredge illustrated herewith is a large and powerful machine built to the order of the commissioners of Lincoln Park, Chicago, for the purpose of filling in the new park extension to the north of the present park. The plan is to reclaim from Lake Michigan an area approximately 1,500 ft. wide by about a mile long by enclosing it with a stone revetment or breakwater and filling in behind it with material taken from the bed of the lake. For much of the distance the breakwater lies in 18 ft. of water and the total volume of fill is about 4,000,000 cu. yds. The breakwater is now partly completed and is made of stone from the spoil-banks of the Chicago drainage canal. A fleet of large scows with several powerful tugs are employed to bring the stone from the canal by way of the Chicago river out into the lake and so to the site of the work.

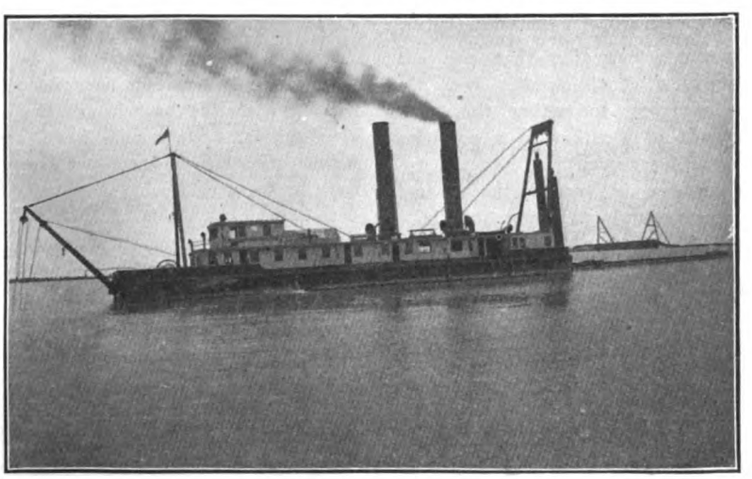


HYDRAULIC DREDGE BUILT FOR THE COMMISSIONERS OF LINCOLN PARK, CHICAGO.

The conditions surrounding the dredging and filling of this work were difficult and peculiar. Not only was the locality in deep water and exposed to the storms of Lake Michigan, which often rise with suddenness and severity, but the soil to be dredged consisted of the tough blue clay which underlies the Chicago area, compacted by the storms of the lake and mixed with more or less gravel and stones.

The ordinary hydraulic dredge as used on the lakes would therefore be unsuitable first because of unseaworthiness, and secondly, because it could only deal effectively with soft material. The usual floating pipe-line connected by rubber sleeves and mounted on a number of small scows or floats would be put out of business with every wind storm or irretrievably wrecked.

The superior economy of the hydraulic process of dredging and filling if it could be successfully applied led Francis T. Simmons, president, and R. H. Warder, secretary, to pursue the subject further to see if these difficulties could be overcome, and they therefore commissioned A. W. Robinson, member American Society of Civil Engineering, to examine and report on the ground and if possible to design a dredge that could cope with the difficult conditions presented. Mr. Robinson had previously designed and built several large hydraulic dredges notably the Tarte which is employed in dredging clay from the bed of Lake St. Peter in the River St. Law-



HYDRAULIC DREDGE BUILT FOR THE COMMISSIONERS OF LINCOLN PARK, CHICAGO.

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rence, and which is provided with a special pipe line for withstanding heavy storms. This dredge is of great power and holds the world's record for output, having dredged 750,000 cu. yds. in a calendar month and delivered 2,000 ft. The original pipe line of this dredge is still in use after having withstood the storms of five years.

It was, of course, realized that Lake Michigan in its angry moods would be too rough to attempt continuous dredging operations, and that the most that could be done would be to provide a plant of large capacity so that the required output could be made after making allowances for weather interruptions, and also seaworthy enough to increase the working time to the largest possible amount. It should also be designed for safe and rapid picking up of anchorages and pipe line in case of storm and to safely withstand any stress of weather when not working. To meet these conditions Mr. Robinson designed the dredge now on the work, which was built by the Atlantic Equipment Co. of 111 Broadway, New York, and put in service in June, 1907.

The hull is of steel 148 ft. long, 38 ft. wide, by 10 ft. 6 in. deep. The main pump has 30-in. suction and discharge and the main engines are of the triple expansion marine type of 1,200 I. H. P. There are two double-ended marine boilers 11 ft. 6 in. diameter x 18 ft. long with eight corrugated furnaces. The installation of engine room auxiliaries such as condensing apparatus, pumps, electric light is most complete and well arranged, the engine room space, in fact, resembling a small ocean liner.

On the upper deck is a pilot house with large plate glass windows, where are arranged all the levers which control the operation of the dredge. Here are also pressure and vacuum gages for all purposes, indicating exactly the work that is being done.

The suction pipe is carried by a very strong steel frame and is fitted with a powerful cutter for digging the clay. This cutter is an improved development of a number of earlier machines and has demonstrated its efficiency by being able to handle the heaviest clay up to the full capacity of the pump. It is 9 ft. diameter and weighs about 9 tons being formed of eight steel blades of peculiar curvature cast in one piece, and having renewable hard steel cutting edges attached. The mechanism for driving and feeding this cutter is of the most powerful description. The secret of success of this dredge is that the excavation of the stiff clay is done by an efficient cutting tool that will not clog and provided with a powerful feed, the main pump being only employed for transportation of the spoil. A capacity rate of 3,000 cu. yds. per hour has frequently been reached in clay, the entire under side of the discharge appearing as continuous slices of blue clay some of the pieces being 4 or 5 ft. long.

One of the most serious problems to be dealt with was that of the floating pipe line. This is the most seaworthy pipe line on the lakes and is formed of semi-submerged steel pontoons about 100 ft. long, connected by ball-and-socket joints having spring connections of great strength. Long lengths of pontoon were necessary to give steadiness in waves and a yielding connection was essential to relieve the joints of the great stresses due to surging. The springs are of locomotive draw-bar size and are arranged similarly to railway car draft-rigging. There are also tension and compression springs to control the side deflection of the joint. In wave-action this pipe line is very satisfactory. A special flange connection is provided at the dredge so that the pipe line can be instantaneously disconnected from the dredge at any time, simply by pulling out a toggle lever. On several occasions when it became too rough for the dredge to work owing to the difficulty of discharging over the breakwater, the pipe line was disconnected and towed to harbor by a tug through a rough sea which broke over both tug and pipes continuously with no harm whatever to the pipe line. These occasions, however, are relatively rare and the operation of the dredge has proved not only that the clay of the bed of Lake Michigan can be dredged by this method, but also that the seaworthiness of both dredge and pipe line is sufficient to reduce the delays on account of weather to a comparatively small amount.

The dredge is named the Francis T. Simmons and its operation is in charge of Messrs. Murphy and Barrett, to whose management the good work done by the dredge is due.

NEW STEAMERS FOR UNITED FRUIT CO.

The heavy increase in the volume of business between the United States and the tropics, and the development of new fruit growing countries in the West Indies has necessitated a heavy increase in the tonnage of the United Fruit Co. which at the present time operate a fleet of something like 60 steamers. The company will shortly inaugurate a service between New York and Surinam, Dutch Guinea, with weekly sailings. This service may later be extended to Boston. The company has in course of construction abroad four large steamers which are building especially for this service. Two of the vessels are building at the ship yard of Workman, Clark & Co., Belfast, Ireland, and the other two are in course of construction at Amsterdam. The steamers will be a trifle larger than the San Jose, Limon and Esparta, the three big refrigerator steamers running between here and Port Limon. The new boats will be 340 ft. long, 46 ft. beam, and 25 ft. depth of hold, with a net tonnage of 2,600 tons and a gross tonnage of 4,000 tons. They will be especially fitted for the service in which they are to engage, and will have splendid passenger accommodations for about 70 passengers. The names selected for the new boats are, Coppename, Saramacca, Suriname and Marowijne. It is not unlikely that Boston may have a direct service to the Windward Islands and Suriname when these steamers are commissioned.

In addition to these four steamers the fruit company has three refrigerator steamers building at Workman, Clark & Co.'s yards, which will be the largest and best equipped fruiters in the world. They will have a gross tonnage of 6,000 tons, and will have a capacity of 65,000 bunches of bananas. These steamers in addition to having a refrigerating system in the cargo chambers, will, by means of an ingenious device, cool the saloons and staterooms by the same process, so that passengers in the tropical climate may enjoy a stateroom kept at as low a temperature as desired.

These steamers will be fitted to carry over 100 saloon passengers, and will have all the luxuries of the ocean greyhounds. They will have several suites of cabin-de-luxe, with gymnasium, baths, etc.

Rapid progress is reported in the construction of these three vessels. The first of the trio is half in frame, and her cellular waterbottom is fully completed. She will be christened Heredia. The name of the second fruiter will be Cartago, and the third will be christened Parismina. The Heredia will be in readiness to leave Belfast on May 15, and about a month later the Cartago will follow. The Parismina will be ready for delivery about July 15.

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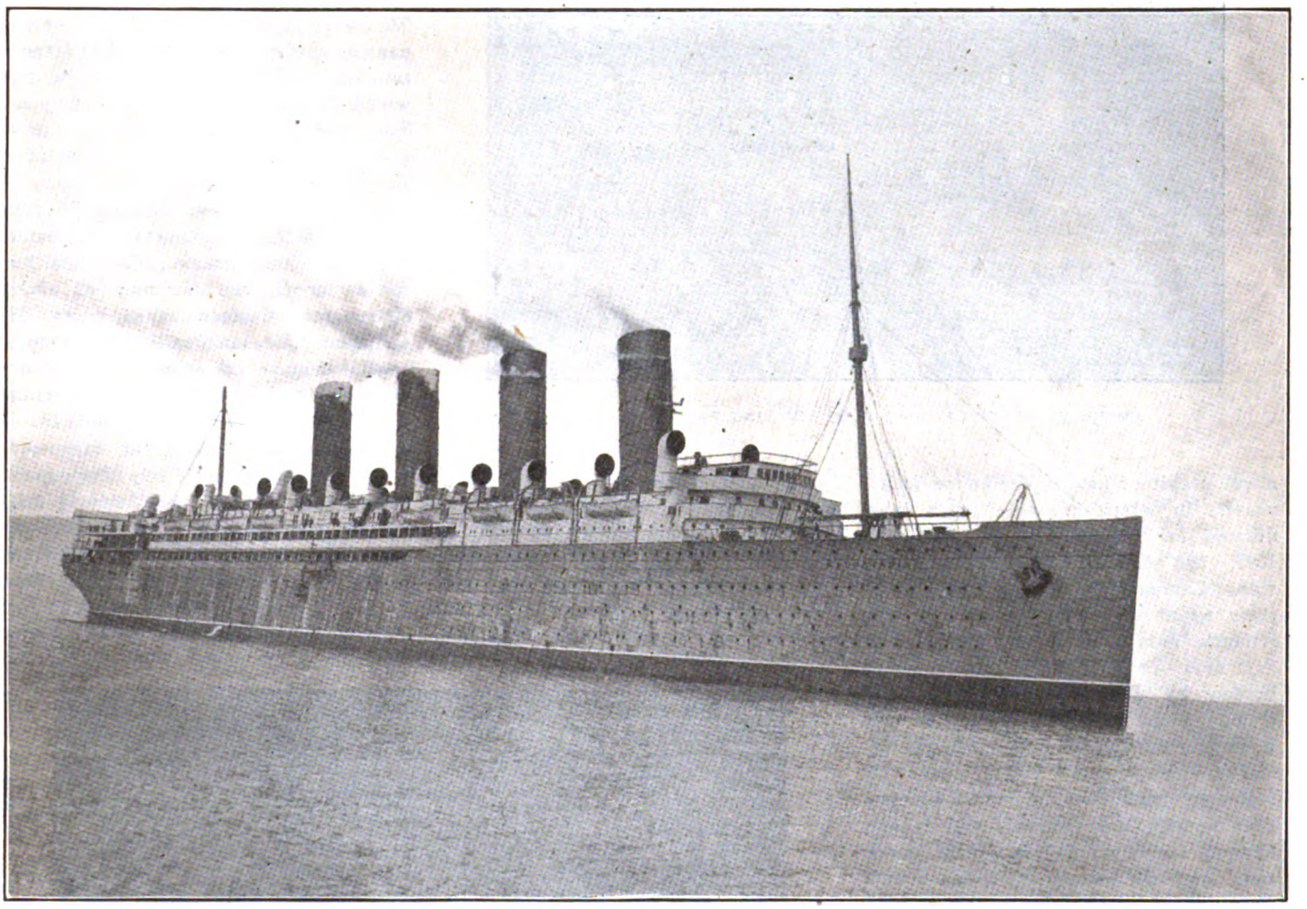
CUNARD LINER MAURETANIA

The Cunard Steamship Co., the owner of the Mauretania, occupies the leading position among the great steamship lines plying between Europe and America. To sketch the history of the famous company is practically to tell the story of the evolution of Atlantic shipping, for since it commenced a regular service of Royal Mail steamships across the Atlantic, in 1840, it has uninterruptedly occupied a premier position in the world's mercantile marine.

The Cunard service was inaugurated by the wooden paddle steamer Britannia, a vessel which at that time marked an advance on anything afloat, and which the press of that day alluded to as the far-famed fast American steamer Britannia. She was 207 ft. long, 34 ft. 4 in. broad, and 24 ft. 4 in. deep. She had a tonnage burden of 1,154; her indicated horsepower was 740; and she was registered to carry 115 cabin passengers, no accommodations being at that time considered necessary for second-class or steerage. The average speed was 8½ knots per hour, and the coal consumption was calculated at 38 tons per day. On the first trip the Britannia accomplished the journey from Liverpool to Boston in 14 days, 8 hours, carrying 63 passengers. The enthusiasm of the welcome accorded to the vessel by the American people on her maiden voyage may be gauged by the fact that Samuel Cunard, who conceived the idea of a regular steamship service, is said to have received 1,873 invitations to dinner within 24 hours of the vessel's arrival at Boston. Lovers of Charles Dickens will recall that it was in the Britannia the novelist crossed the Atlantic in 1842; and the opening chapter of his "American Notes" is devoted to a delightfully humorous description of the stateroom which he and his wife occupied—"the pleasantest and most facetious and capital contrivance possible," to have had, which one inch larger "would have been quite a disagreeable and deplorable state of things."

A study of the steamers which have gone to make up the Cunard fleet since the time of the Britannia to the advent of the Mauretania, presents a reliable index to the development in naval architecture during the last sixty-seven years. In 1862, their iron paddle steamer Scotia, of 3,871 tons gross register, with engines of 4,900 H. P., steamed 14.4 knots, and reduced the record from Liverpool to New York to 8 days, 22 hours. Five years afterwards, the Cunard liner Russia, of 2,960 gross tons, demonstrated the superiority of the screw propeller as compared with the paddle as a means of propulsion for ocean-going vessels, by steaming 13 knots on a coal consumption of only 90 tons per day; while the Scotia, with her paddles, was burning 159 tons per day to attain the same speed. The Servia, one of the earliest vessels to be built of steel, was launched in 1881; and the ever-popular Umbria and Etruria, each capable of maintaining a speed of 20 knots, followed in 1884. The Umbria and her sister were the last large vessels of the



CUNARD TURBINE LINER MAURETANIA.

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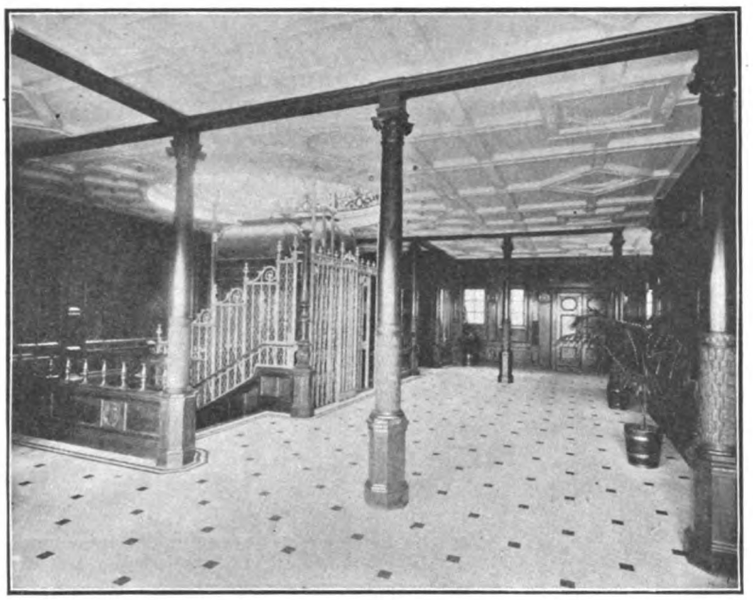
Cunard company to be fitted with single-screw engines, and they may be said to represent the highest degree of proficiency attained by the



GRAND ENTRANCE ON BOAT DECK SHOWING PASSENGER LIFTS.

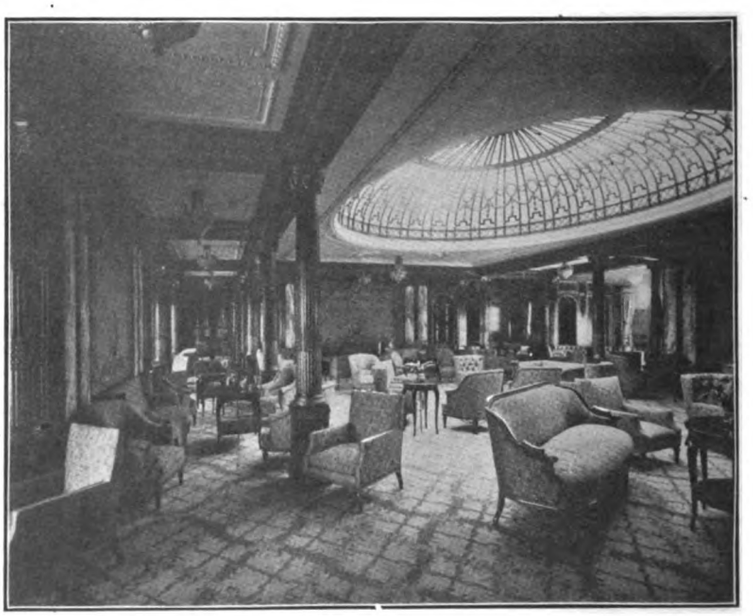
naval architect in the design of large vessels in which a single screw was utilized for propulsion. In 1892 and 1893, the Cunard twin-screw sister ships Campania and Lucania, with their speed of 22 knots, lowered the Atlantic record to a few hours over five days—records which are yet unbeaten by British-owned steamships if we except the performance of the Lusitania during the last two or three weeks.

Recent additions to the Cunard fleet include the spacious and steady Ivernia and Saxonia, of 14,000 gross tons, and the luxurious Caronia and Carmania, of 20,000 tons. Ever ready to take advantage of the latest developments in ship building and marine engineering, the Cunard company, in the last-named vessel fitted propelling machinery on the turbine principle, a system which had previously been decided upon for the giant vessels Lusitania and Mauretania. With these two new steamships, the magnificent fleet of the Cunard company comprises twenty-three vessels, representing a total gross tonnage of 245,979. The following is a list of the vessels at present constituting the Cunard fleet: Mauretania, Lusitania, Carmania, turbines; Caronia, Saxonia, Ivernia, Carpathia, Lucania, Campania, Slavonia, Ultonia, Pannonia, Umbria, Etruria, Sylvania, Brescia, Veria, Pavia, Cypria, Tyria, Saragossa, Aleppo, Cherbourg.

THE MAURETANIA'S BUILDERS.

The Mauretania has been built by Swan, Hunter & Wigham Richardson, Ltd., of Wallsend and Walker on Tyne. The history of the ship building company carries us back to the early days of iron ships. In 1842, or just two years after the Britannia commenced running, the first iron vessel ever built on the Tyne, the Prince Albert, was launched from the site of the present South Yard of the company's Neptune Works, Walker. The area of the ship yard in 1860 was only four acres, with a river frontage of 107 yds., and there were three building berths, the longest being 320 ft. Two hundred men at most were employed, and the maximum annual output of ships was about 4,000 gross tons. The area of the Wallsend yard in 1880 when Mr. Hunter took charge of it, was under seven acres. The area of the company's present premises is seventy-eight acres, with a river frontage of about three-quarters of a mile. Last year twenty-five vessels of a total gross tonnage of 126,921 were launched from the company's yards, this being the largest tonnage built by any firm in the world during 1906 or in any one year. The works when in full operation give employment to about 8,000 men and boys.

In addition to the world-wide reputation of the company for the building of floating graving docks, it has to its credit the building of about 800 merchant steamers of every description. The company has made a special feature of Atlantic vessels, the chairman of the directors, G. B. Hunter, D. Sc., in particular having closely studied both the great cargo-carrying steamers and the high-speed liners now used in the Atlantic traffic, and, with C. S. Swan, another director, he has watched every detail in the construction of the Mauretania. Swan, Hunter, & Wigham Richardson's connection with the Cunard company dates back to 1898, when they built the Ultonia. This steamer was followed by the large intermediate liners, Ivernia and Carpathia,



FIRST-CLASS LOUNGE AND MUSIC ROOM.

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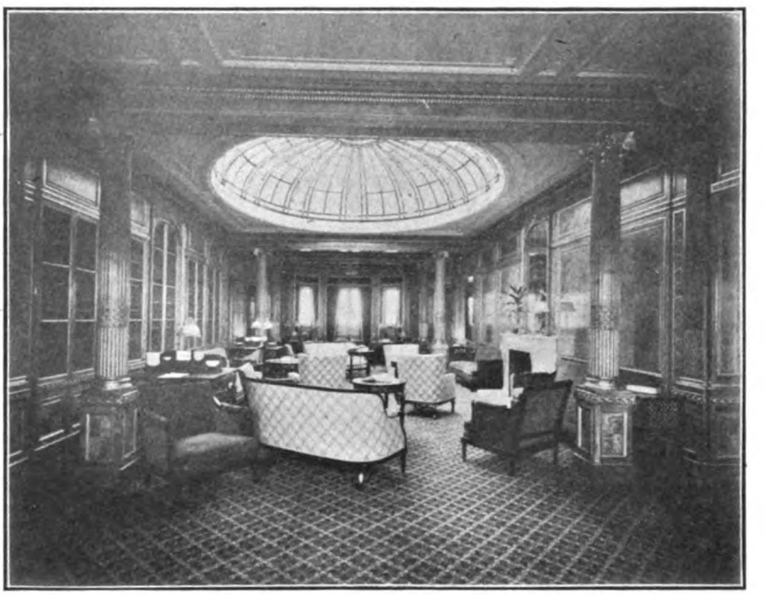
which have a great reputation among Atlantic travelers for comfort and steadiness in a seaway.

The Mauretania was constructed on a building berth specially laid out for her and piled the entire length in order to support the great weight of material to be wrought into the vessel. This berth is covered with a shed, of girder lattice work and roofed with glass, 740 ft. long, with a clear inside width of 100 ft. and a height of 144 ft. Seven electric overhead cranes, some of 3 tons and others of 5 tons lifting capacity, were fitted in the roof of this shed, and for lifting heavier weights up to 10 tons the cranes were arranged so that two could be made to work in conjunction.

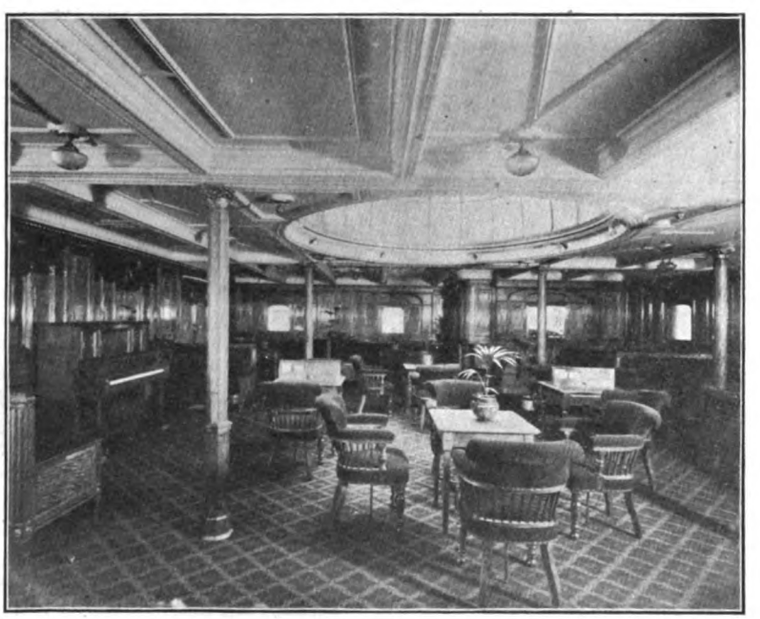
It is interesting to recall that the latest Cunarder was built on the site of the important Roman stronghold of Segedunum, which existed from about the year 280 A. D. to about 400. Segedunum marked the easternmost end of the great wall built by the Romans and which spanned Britain from the Solway to the Tyne. During excavations in the Wallsend ship yard shortly before the laying of the keel of the leviathan, a portion of the wall was uncovered, and many coins and other proofs of the occupation of Britain's ancient conquerors were unearthed.

THE ENGINE BUILDERS.

The Wallsend Slipway & Engineering Co, a firm intimately connected with the ship builders, has constructed the turbines and boilers of the Mauretania. This company, established in 1875, is well known throughout the world for the engines it has built for the leading steamship companies, and for the British admiralty. The Wallsend Slipway Co. has been responsible for the design of the turbines, working with the Parsons Marine Steam Turbine Co., also of Wallsend, and with James Bain, the general superintendent of the Cunard company. For the construction of the propelling machinery Andrew Laing, director and general manager of the Slipway company, has been primarily responsible. His experience in the building of engines for large mail steamers and war vessels, both on the Clyde and the Tyne, is unsurpassed.



FIRST-CLASS LIBRARY.



SECOND-CLASS SMOKING ROOM.

THE DESIGN OF THE VESSEL.

Not only the British empire, but the whole world, owe a debt of gratitude and a tribute of admiration to the Cunard Steamship Co. for the great enterprise and courage they have shown in the inception of two steamships like the Mauretania and her sister. The death of the second Lord Inverclyde, who as chairman of the Cunard company in 1903 entered into the agreement with the British government that led to the building of the vessels, was an irreparable loss to the British mercantile marine, and it is a sad reflection that he who was so largely responsible for the construction of the huge ships is not present to see the practical outcome of his great scheme. The present able chairman, William Watson, and the other directors of the company, have carried on the work to a successful issue.

The conditions laid down in the agreement entered into in 1903 between the British government and the Cunard company required the construction of two steamships "capable of maintaining during a voyage across the Atlantic a maximum average speed of from 24 to 25 knots (say, 27 to 29 statute miles) per hour in moderate weather." This stipulation, coupled with the large amount of passenger accommodation aimed at, the stringent requirements of the British admiralty, and the determination of the owners to make the vessels much stronger than any other

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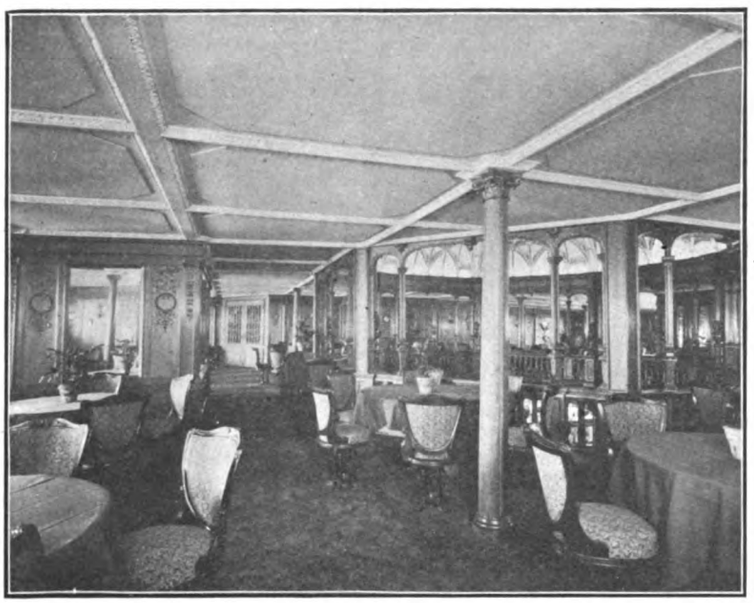
fast Atlantic vessel afloat and to introduce every known contrivance for the safety and comfort of the passengers, compelled the designers to adopt unprecedented dimensions.

The question of the best means to be adopted for propelling such a huge structure at the speed of a railway train over a distance of about 2,900 knots without a stoppage was the greatest problem that marine engineers had been called upon to solve. It was generally conceded that, with the ordinary form of reciprocating engine, the limit of speed practicable for Atlantic passenger steamships had been almost reached. The alternative means of propulsion—the steam turbine—was as yet only in its infancy so far as its application to marine work was concerned. The turbine propelling machinery fitted in cross-channel steamers, in destroyers, and in His Majesty's third-class cruiser Amethyst, was of very much smaller power than that required for the two Cunarders. At that time the turbine-driven Carmania, already referred to, had not been designed.



PORTION OF FIRST-CLASS UPPER DINING SALOON.

To study the question closely, a commission was appointed with James Bain (representing the Cunard Steamship Co.) as chairman, and consisting of Rear Admiral H. J. Oram (representing the British admiralty), Sir William H. White (Swan, Hunter, & Wigham Richardson), Andrew Laing (Wallsend Slipway Co.), the Hon. C. A. Parsons, C. B., J. T. Milton (Lloyds Register), Thomas Bell (John Brown & Co.), and the late Wm. Brock (Denny Brothers), with Engineer Lieutenant W. H. Wood, R. N., as secretary. After some months of research and experiment, this commission unanimously reported in favor of the adoption of marine steam turbines on the Parsons principle. Thus, the propelling machinery of the Mauretania is the greatest practical tribute to the inventive genius of the Hon. Charles Algernon Parsons, whose Turbinia Works at Wallsend lie midway between the premises of the ship builders and those of the constructors of the vessel's machinery.

Models of the proposed steamships were designed by Swan, Hunter, & Wigham Richardson, John Brown & Co., and Vickers, Sons and Maxim, and tested by R. E. Froude in the admiralty experimental tank at Haslar, and further models of increased breadth and finer lines were made and tested under the directions of Sir Philip Watts, director of naval construction.

As a further instance of the care and patient research which have characterized those responsible for the design and construction of the great liner, the model experiments carried out by Swan, Hunter, & Wigham Richardson may be quoted. An exact model of the vessel, 47½ ft. long, and provided with electrically-driven propelling machinery, was built, and a series of experiments commenced in order to arrive at the most suitable form of the after lines of the ship, and the number, position and design of propellers likely to give the most satisfactory results. These investigations, which extended over about nine months, were the most elaborate of their kind ever carried out, and the data derived was of great value to the builders. In many questions arising during the designing and building of the Mauretania, the builders have had the benefit of the advice of Sir William H. White, K. C. B. (formerly director of naval construction and assistant controller of the royal navy), who has acted as consulting naval architect.

The following are the leading dimensions of the Mauretania:

Length over all	790 feet
Length between perpendiculars	760 feet
Breadth, extreme	88 feet
Depth, molded	60 feet 6 inches
Gross tonnage	32,000 tons
Maximum draught	37 feet 6 inches
Registered displacement	44,640 tons

Brunel's wonderful creation, the Great Eastern, the standard by which the public endeavor to obtain an idea of the size of our greatest modern steamships, was 95 ft. shorter, 5 ft. less in breadth, and 3 ft. less in depth than the Mauretania, while the gross tonnage was 7,640 short of the Cunarder's.

The two fastest German liners now crossing the Atlantic are the Kaiser Wilhelm II and the Deutschland. The gross tonnage of the former is 12,000 less, and that of the latter 15,498 less than the tonnage of the Mauretania. The new Cunarder and her sister the Lusitania are the largest vessels in the world and the fastest merchant steamers afloat. The Mauretania, however, is actually a little larger than the other vessel, being greater in depth by 5 or 6 in. To the uninitiated this increased depth appears insignificant; but extending the vessel's total length of 790 ft., it represents an addition of about 300 tons to the gross tonnage when compared with the Lusitania.

The hull has been constructed of steel on the cellular double bottom principle, with floors on every frame. The double bottom is extended well up the ship's sides, thus affording great additional protection in the event of the liner grounding, at the same time giving structural strength transversely and longitudinally. The plates on the vessel's shell, and the heavier plates on the decks, are in most cases 35 ft. long, and weigh 2½ to 3 tons each. In some instances, however, the length of the plates is 48 ft., weighing 4 to 5 tons—a record size for ship plates of this description. In the top part of the structure, subject to great stresses when the vessel is in a seaway, special high-tensile steel has been employed.

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One of the differences between the Mauretania and the Lusitania is, that in the former vessel, a greater use of high-tensile steel has been made, which has resulted in a reduction of weight and increasd capacity for carrying fuel and deadweight cargo. Most of the riveting of the bottom, upper shell plating, and part of the decks was done by hydraulic pressure.

The Mauretania has nine decks, the lower orlop, orlop, lower, main, upper, shelter, promenade, boat and sun decks. The promenade, boat and sun decks are above the main structure of the vessel. A tier of deck houses, running for about half the length of the ship, is erected on the boat deck, the whole being surmounted at the fore end by the commander's bridge, which is about 100 ft. above the keel. The fore ends of the deck houses are curved, so as to reduce wind resistance as the vessel steams ahead.

To ensure the safety of the ship in the event of collision, the subdivision by watertight bulkheads and decks is the most elaborate that could be devised for a passenger vessel, the number of separate watertight compartments — 175 — rendering the ship practically unsinkable. All watertight doors fitted to the main bulkheads are so arranged that they can be instantly closed in case of accident, the apparatus for performing this operation being worked by hydraulic power, electrically controlled from the bridge, where there are indicators which always show at a glance whether each watertight door is open or closed.

About 26,000 steel plates were used in the shell, decks, bulkheads, casings, etc., of the vessel. Over 4,000,000 rivets were worked into the ship, weighing 700 tons. The main piece of the stern frame, which is of cast steel, weighed very nearly 50 tons. The balanced rudder is formed of steel castings which are hollow and shaped to reduce resistance. The rudder head, 25½ in. in diameter, is of forged ingot steel. The parts are bolted together, and have a united weight of about 64 tons. The rudder and steering gear are entirely below the water-line, for additional protection in the event of the vessel being fired upon if used as an armed cruiser in time of war. The total weight of the main castings, including rudder, stem bar, stern frame and propeller brackets, exceeds 200 tons.

THE PROPELLING MACHINERY.

The Mauretania's turbines and boilers, with coal bunkers, occupy a total length of from 400 to 450 ft. amidships, with a depth from the main deck to the double bottom. The coal bunkers along the sides of the ship are so arranged that they will afford protection to the most vital and important parts of the vessel if used as a scout or cruiser in time of war. For the same reason the principal machinery is placed below the water-line of the ship. Two high-pressure and two low-pressure turbines are provided, each having a separate shaft and each driving one propeller. The total power developed is about 65,000 to 70,000 I. H. P., so that each of the Mauretania's four propellers exerts nearly 24 times the power of the paddle steamer Britannia, the first Cunard steamer. Throughout, the machinery of the new vessel (including the steering gear and engines) has, as far as possible, been duplicated, so that in the event of accident she can always be worked by one set of engines. When the engines are running, the rotating mass in the engine rooms weighs 600 tons, and this weight revolves at about 200 revolutions per minute. So great is the accuracy necessary in the construction of turbine machinery that the whole must be under control and measurement to the one-thousandth part of an inch and balanced to an ounce. Some of the larger castings which form the low-pressure turbine casings weigh 38 tons each. The weight of the ingots from which the large drums were forged was 120 tons each. About 1,500,000 blades have been fitted in the turbine machinery, and if these blades were placed end to end they would extend a distance of about 110 miles.

Steam is supplied by twenty-three double-ended and two single-ended boilers, having 192 furnaces in all. Air is supplied to the boilers by Howden's system of forced draught, the fans being driven by electric motors. If the boilers, which are arranged in the ship in four stokeholds, were placed on end one above the other, they would form a column 547 ft. high, or about one-tenth of a mile. The four elliptical funnels rise 152 ft. above the keel of the vessel. If placed on their sides they would form an elliptical tunnel inside of which two locomotives of the ordinary type could pass each other. On the occasion of the launch of the Mauretania, the vessel's funnels lay on the ground end to end at the works of the Wallsend Slipway Co., and many of the visitors were driven in motor cars through the tunnel thus formed, which had a total length of 430 ft. Lunch could be taken in one of the funnels by 250 people comfortably seated at tables. The aggregate length of the steam and feed pipes in the machinery rooms is about 1¼ miles. Independent of the pipes for steam and water connections, there are about 144 miles of brass and steel tubes in the boilers, condensers, etc.

As will be readily understood, the coal consumption to drive the Mauretania across the Atlantic is very great. It is computed that, for a trip from Liverpool to New York and back, about twenty trains, each with twenty large trucks of coal, would be required. Approximately, 350 firemen and trimmers will be required to deal with the coal.

PASSENGER ACCOMMODATION.

The passenger accommodation of the Mauretania when its spaciousness and beauty of decoration are taken into account, certainly justify the use of the somewhat extravagant term, "a floating palace." It is claimed that the vessel offers 50 per cent more light and air space and deck promenade per passenger than any other liner afloat with the exception of the Lusitania. The following list gives the accommodation provided:

First-class passengers	560
Second-class passengers	475
Third-class passengers	1,300
Crew	800
Total	3,135

There are in all 253 staterooms for first-class passengers, 133 for second-class, and 278 for third-class.

THE FIRST-CLASS ACCOMMODATION.

The accommodation for first-class passengers placed amidships extends over five decks—the main, upper, shelter, promenade and boat decks. Access from one deck to another is obtained by means of the grand and other stair cases, and by two separate electric passenger lifts, which travel from the main to the boat deck.

The greater part of the accommodation for passengers, officers and crew has been carried out by the ship builders in their own workshops. This includes all the second-class public rooms, the first-class corridors, and the majority of the first-class staterooms. The following work has been done by sub-contractors: The first-class lounge and library, by Messrs. Ch. Mellier & Co., London; the first-class dining rooms, smoking room, the grand entrances, 54 special staterooms, and the regal suites, by Messrs. Turner, Lord & Co., London; the children's room and sixteen special staterooms, by Messrs. Robson & Sons, Newcastle-on-Tyne.

The grand entrances and staircase are in the style of the sixteenth century, Italian. The woodwork is in French walnut, the panels being ve-

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neered with the finest figured wood. The utmost difficulty was experienced in obtaining a sufficient quantity of veneers of the quality aimed at for so extensive a work, both England and France being searched for what was needed. Except in the Mauretania's sister ship, there is no similar staircase afloat, resembling as it does those found in private mansions ashore. The two lifts, or elevators, are arranged in the well of the staircase. The "grille" or railing round them is of aluminum, the design being adapted from some antique wrought ironwork of the sixteenth century. The soft tone of the aluminum gives a cheerfulness to the more somber walnut woodwork. Attention is also directed to the aluminum work in the front of the bureau on the promenade deck.

The carving of the woodwork on the staircase and in the entrances is somewhat similar to that in the dining saloons, to which reference will be made later. In the carved capitals of both pilasters and columns a variety of design has been introduced.

All the grand entrances are laid with india rubber tiling, in black and white, the latter color prevailing.

THE MAIN DECK.

A large number of first-class staterooms are situated on the main deck, within convenient reach of the staircases and lifts. These staterooms, which are very large in size, are arranged for one, two or three passengers, the number of berths fitted for the latter number being comparatively few.

THE UPPER DECK.

Proceeding upwards by the lift from the main deck, we next reach what is known as the upper deck. Immediately abaft the grand entrance is the lower grand dining saloon, while two spacious corridors, one on each side of the vessel, lead in the opposite direction, giving access to numerous staterooms on this deck.

On this deck there are also a number of special cabins, the distinguishing feature of which is that each has its own lavatory in a small recess, curtained off from the main portion of the apartment. This lavatory is fitted with dressing mirror, sponge and soap trays and all other accessories, and hot and cold water service. These rooms are paneled in white, and the furniture is executed in a variety of woods, such as satinwood, oak, mahogany, and walnut. A brass bedstead of special design is fitted in each room. Above the bed is a folding berth, which can be hinged back when not in use. A sofa is provided on the opposite side of the room near the wardrobe and a handsome dressing and writing table combined has also been added.

The ordinary staterooms on this deck are fitted to accommodate one, two or three passengers, and are furnished with folding lavatories, dressing tables, sofas and wardrobes. The furniture is in mahogany, forming a pleasing contrast to the white paneling of the rooms. The wardrobes are fitted with patent hinges so that the doors when open remain stationary in any desired position, and they are so placed that the looking glasses fitted in the doors and the dressing table mirrors give a double reflection, thus facilitating the toilet. Even small details like the hooks on the stateroom doors have been carefully studied, those fitted being noiseless and patented by the ship builders.

THE SHELTER DECK.

On this deck will be found the children's room and the upper dining saloon. The work in the children's room has been carried out in mahogany, white enameled, the paneling on the walls being decorated with paintings illustrating the nursery rhyme, "Four and twenty blackbirds." Dining tables and seats, of suitable height for the little passengers, are provided; and the big rocking horse in the center of the room will no doubt be much in demand. The windows in the children's room, as in the public rooms generally, are square, and not the usual circular lights used in ship work. A children's lavatory and pantry, besides rooms for four stewardesses and two matrons, open off the children's room.

THE DINING SALOONS.

The dining saloons, two in number —the upper and the lower—are situated on the upper and shelter decks. Between the two rooms is a large open space terminating in a groined dome designed to carry out one complete scheme, the whole producing a rich and airy effect. The rooms are executed in oak. The style chosen for these two saloons is that known as Francois Premier, the type most closely followed being that prevailing between the years 1540 and 1550. One of the charms of this style is that no piece of carving is an exact reproduction of its neighbor. Some of the most delicate work is shown upon the arched bulkheads which run at right angles to the sides of the ship. All the carving in these rooms has been cut back from the face of the solid wood.

The aim of the designer has been to keep the larger and lower room richer in carving, leading up to a simpler treatment in the upper dining saloon, and terminating with the crowning feature of the lofty groined dome. The interlacing of the groins has been carefully planned, with small enriched circles at the cross sections, introducing the signs of the Zodiac. At the top is an octagonal open balustrade, through which hidden electric lamps throw light against a gilded convex disc, shedding a soft, warm sunlight glow over the whole room.

The floor covering is in cerise red. The long tables usually found in the dining saloons of the older Atlantic liners have been discarded, and small tables have been adopted in both the lower and upper dining saloons. In the lower dining saloon the tables accommodate from five to fourteen passengers, and in the upper saloon parties of from two to six persons can be seated at each table. The lower dining saloon, which is 87 ft. long, extends the full width of the ship, and is thus almost square, provides seating accommodation for 325 passengers. The upper dining saloon is 62 ft. long by 66 ft. wide, and seats 152 persons. The height from the floor of the lower dining room to the top of the dome is about 28 ft.

THE PROMENADE DECK.

Continuing our journey upwards by the electric lift, we reach the promenade deck. Facing the lift in the grand staircase is the bureau, with its aluminum front. The two regal suites and a large number of en suite rooms are on this deck, as are also some simple Sheraton rooms, some Georgian rooms in white with silk panels, a large number of more ordinary staterooms for one and two persons, a few three-berth rooms, the barber's shop, and the look-out. All the windows on the promenade deck are square, similar to those we are accustomed to in our houses.

THE REGAL SUITES.

The regal suites, one on each side of the vessel, comprise drawing room, dining room, two bed rooms, bath room and private corridor, all shut off from the main corridor. The drawing and dining rooms on the port side are paneled in East India satinwood, the veneers of the panels being laid across the angles converging to the centers, with just sufficient carving to make the rooms interesting. They are divided by wide sliding doors, so that they can be used as one large room if required. In the drawing room a gilding has been added, and a silk tabouret in a charming tone of green has been selected for the wall panels. The rooms are

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warmed by electric radiators fitted with statuary marble mantel-pieces, The style is a simple form of Adams, admirably adapted to rooms on this scale. The two bed rooms are Georgian in character, with carved mouldings. The wall panels are covered in silk, corresponding to that used in the two reception rooms. The bed rooms are finished in white, the furniture is mahogany, and the whole effect is so homelike that it will be easy for passengers to imagine themselves ashore.

On the starboard side the regal suite is carried out in a very similar style, with the exception that a delightful tone of rose is substituted for green, and in the case of the two reception rooms the wood chosen for the dining room is "fiddle-back" sycamore, treated and inlaid, and the drawing room is "fiddle-back" sycamore of a soft grey tone, inlaid delicately with hollywood. The effect of the color of the woodwork, with the rose carpet and silk hangings, is very pleasing.

THE EN SUITE ROOMS.

The style selected throughout the en suite rooms is generally similar to that in the regal rooms, but a variety of effect has been obtained by a judicious choice of woods, in the silk hanging, and in general coloring. Without attempting to minutely describe each room in detail, we may take as types: (1) the pear-tree room, with its inlay of hollywood and its cream and green upholstered surroundings; (2) the "fiddle-back" sycamore room, where the coloring is relieved with inlays of green wood in the pilasters and frieze panels, with cornice and paneled ceilings, silk hangings, and carpets carefully selected to be in harmony; and (3) the room in which the sycamore is of a soft grey color, with a relieving inlay in holly and pear-tree. Mention might also be made of the several varieties of white rooms, with carved mouldings and mahogany furniture; or the rooms paneled in satinwood, inlaid with faded mahogany. Most of the en suite rooms have recesses curtained off and fitted with washstands in onyx marble. In many of the rooms the wall panels are covered with cream silk, and in some cases a border of embroidery has been added, taking up the colors of inlays on the paneling and the carpets. In other cases the panels are framed with lace laid on a contrasting color and embroidered at the sides.

The barber's shop for the use of first-class passengers, on the promenade deck, is fitted with Kock's patent chairs, electric water boilers, etc.

THE LOOK-OUT.

Near the fore end of the vessel on the promenade deck is the look-out. This apartment, situated in the fore end of the deckhouse, commands an uninterrupted view over the bow of the vessel and affords complete protection from the weather. Passengers will therefore be able to watch the vessel forging ahead without being exposed to the wind resistance caused by the great speed at which she will travel.

THE BOAT DECK.

Again ascending by the lift, the boat deck is next reached. Opening aft from the grand entrance is the first-class lounge and music room, while forward of the grand entrance is the library. The smoking room is also on this deck as well as several en suite rooms, Sheraton and Adams staterooms, special single-berth staterooms, and a large number of two-berth rooms. No stateroom on this deck is intended to accommodate more than two passengers. All windows on the boat deck—both in the public rooms and cabins—are square and of large size, so arranged that the incoming air may be readily baffled to prevent it blowing directly on the occupant of the cabin.

The en suite rooms are generally similar to those on the promenade deck, finished in various woods, with silk panels, and each is provided with its own private bath room.

THE ADAMS, SHERATON AND CHIPPENDALE ROOMS.

The inlaid rooms are revelations of clever workmanship and harmony of design, following in the truest spirit along the lines of those old masters of the cabinet-making craft, the Brothers Adams, Sheraton and Chippendale. The material used is carefully selected timber, sawn from logs acquired thirty years ago, of beautiful figure. The two Sheraton rooms each contain two brass bedsteads.

THE FIRST-CLASS LOUNGE AND MUSIC ROOM.

The lounge or music room is decorated in the style which obtained in France in the last quarter of the eighteenth century, of which the Petit Trianon is perhaps the best example. It is difficult at first to realize that one is on shipboard when in this beautifully shaped apartment, with its rows of stately columns and its semi-circular bays. The height and magnitude of the apartment is beyond imagination when associated with a steamship afloat. The paneling, columns and pilasters are of mahogany, the panels being cross-veneered to give the best effect to the grain. The woodwork is dull, polished a rich golden brown, the mouldings and all the carvings being fully gilt. Sixteen pilasters of Fleur de Pechar marble with chased ormolu capitals and bases, a chimney piece of the same materials, and three fine panels of tapestry, with the westeria color of the marble, give a beautiful effect in color, and break up successfully the wide expanse of mahogany and gold. The elliptical dome, of wrought iron with gilt ornaments, and the plainly paneled white ceiling, from which depend crystal electroliers, complete a room which, it is claimed, surpasses anything before attempted in a ship. The specially designed carpet has a cream tone corresponding to the curtains, with a trellis work of laurels and roses, recalling the colors of the tapestry on the walls. The chairs and sofas of polished beech are covered with various colored brocades—all reproductions of Louis XVI designs. The tables, of various sizes, scattered about the room, command attention by their color and shape, being for contrast destitute of all extraneous ornament.

FIRST-CLASS LIBRARY.

The library, a somewhat smaller apartment than the lounge, is decorated in the same style, but the color scheme is entirely different. The wall paneling is of sycamore, stained a silver-gray. The veneering was so selected as to bring out the beautiful grain, the plainer portions of the wood having been discarded. As in the lounge, the carved mouldings and other ornaments are gilt to harmonize with the paneling. The bookcase, instead of being a separate piece of furniture, forms the paneling of one side of the central portion of the room, the delicate carving and gilt trellis of the doors enhancing the beauty of this wall. On the opposite side of the room is an open fireplace with carved chimney-piece, all of white statuary marble, surmounted by a mirror. The carpets and curtains are of deep rose color, the latter being relieved by borders of colored brocade. This color also predominates in the covering of the seats, the frames of which are of mahogany, copied exactly from antique models. The writing and other tables are also of mahogany. The ceiling and dome, the crystal chandeliers and other accessories, are similar to those of the lounge, but quite distinct in detail. Attention is also drawn to the treatment of the swing doors in both the lounge and library. The panels are fitted with square beveled glasses, and the narrow dividing rails are of richly

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chased and gilt ormolu. By the use of clear glass panels in the doors, the range of view is much extended, reaching as it does to the beautiful corridors and adjoining spacious rooms, a total distance of about 350 ft.

FIRST-CLASS SMOKING ROOM.

The first-class smoking room, situated on the boat deck, can be reached by a lobby entering from the open-air promenade or through the lounge. The period selected for the decoration of this room is the same as that of the grand entrance and staircase, namely, sixteenth century, Italian; but it differs inasmuch as it is much richer in the carvings, and it is relieved round all the panels with an inlaid border of sycamore. An interesting feature is a jube extending the length of the room, divided into recesses, with divans and card tables. Two secluded recesses at one end of the apartment are fitted with writing tables. The windows in the recesses are of unusual size and of unique design for ship work. They have been successfully treated with semi-circular arches, giving the appearance of the windows of an old fashioned private house. In the center, at the forward end of the room, is perhaps the main feature of the scheme, an open fireplace with a massive chimney-piece surmounted with a carved wood hood.

THE SECOND-CLASS ACCOMMODATION.

The accommodation for second-class passengers—like the first-class—extends from the main to the boat decks, but it is further aft. An inspection of these apartments reveals the fact that only in magnificence, but not in comfort, are the second-class quarters surpassed by the first-class accommodation. In the general design and in the treatment of detail, the same care has been exercised; and indeed a passenger coming on board for the first time might well be excused for mistaking the second-class public rooms and staterooms for the first-class. Only a very few years ago such accommodation would have been considered fully worthy of first-class passengers, and if one feature more than another will make the Mauretania popular with Atlantic travelers it will be the beauty and comfort of this section of the accommodation. In catering for this class of passenger, the Cunard Co. may fairly claim to lead the way among the great steamship lines plying between the Old and the New Worlds.

The second-class staterooms are all on the main, upper and shelter decks, while the public rooms are on the promenade and boat decks.

THE SECOND-CLASS GRAND ENTRANCES AND STAIRCASES.

The second-class grand entrances, like the first-class entrance, extend from the main to the boat deck. These apartments are in specially selected teak, beautifully marked. The floors throughout are laid with rubber tiling, in a simple design of black and white, the latter color predominating. The grand and auxiliary staircases are in teak, similar to the entrances, and ascend from the main to the boat deck, thus giving access to all the second-class quarters.

THE MAIN DECK.

There are in all 70 second-class staterooms on the main deck, each accommodating two or four passengers. These cabins—as in most of the first-class rooms—are panelled in white, with mahogany furniture. Sofas, wardrobes and lavatory compactums are fitted; and here again the mirrors above the compactum and in the wardrobe doors have been so arranged as to give a double reflection. The wardrobes are also fitted with patent hinges, causing the doors to remain stationary in any required position. As in the first-class cabins, patent silent door hooks are fitted, so that passengers will not be worried by the usual jingling noise.

The upholstery throughout all the second-class state rooms is in dark morquette, the carpets being of crimson Brussels. The window curtains are in blue chalic, and the door curtains in crimson chinelle.

THE UPPER DECK.

On the upper deck are situated the second-class dining room, 39 staterooms, and the barber's shop, the latter fitted with Kock's patent chairs, electric water boilers, etc., generally similar to the first class barber's shop. The staterooms are generally similar to those on the main deck.

THE SECOND-CLASS DINING SALOON.

The second-class dining saloon which opens off the grand entrance is 61 ft. long and the full width of the ship, with a height of 10 ft. The style of the room is Georgian, with carved cornice. The design is executed in oak, and the floor is laid with parquetry, to harmonize with the walls. Above the center of the room is a large octagonal opening, communicating with the grand entrance on the shelter deck above, and forming the dome of the dining saloon. This dome has a total height from the floor of the dining saloon of 19 ft. An electrolier, of handsome design, is suspended from the center of the dome, and is surrounded by smaller electric lights. A massive carved oak sideboard is a striking feature at the after end of the dining saloon, while immediately opposite is the piano. The tables, at which 250 persons can be seated, are also in oak. Brussels carpet runners of a bottle green are laid on the polished floors between the tables, and the revolving chairs upholstered in frieze velvet of the same color. The windows round the sides of the room are arranged in pairs; and the room generally has a light and airy appearance which is considerably enhanced by the lofty dome.

SHELTER DECK.

Some special second-class cabins may be seen on this deck, which, with their large square windows and other fittings, are only slightly inferior to the first-class staterooms. On the shelter deck the grand entrance extends over part of the dining saloon, and the passengers can walk round the balustrade and view the dining saloon below through the octagonal opening.

PROMENADE DECK.

On the promenade decks are the second-class drawing room and smoking room.

SECOND-CLASS DRAWING ROOM.

Opening forward from the grand entrance is the second-class drawing room fitted up in a variety of maple woods, with gold decorations. In style this room is a free translation of the Louis XVI. period. A dome of obscured glass with gilded metal framework, surmounts the apartment. In the walls are large square windows. These windows are of special construction, patented by the shipbuilders, and each is fitted with an obscured glass screen, which can be lifted at will. This room has been specially designed as a quiet retreat for lady passengers. The sofa seats and chairs are upholstered in crimson frieze velvet, and the window curtains are of a tint to harmonize. The carpet is of crimson Brussels, and the small tables scattered about the room give the appearance of ease and comfort. A piano is also provided.

SECOND-CLASS SMOKING ROOM.

The smoking room, opening aft from the grand entrance on the promenade deck, is late Georgian in style. It is fitted up in mahogany, inlaid with English boxwood and Burr mahogany, giving an artistic effect. The upholstery of the chairs and sofa seats is in dark blue velvet pile morquette. The floor is covered with inlaid linoleum, with dark blue Brussels carpet runners. The dome overhead and the windows in the walls

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NEW C. P. R. STEAMER.

On Friday, Nov. 1, the new and unique steamer, Princess Ena, built at Liverpool by Messrs. H. & C. Grayson for the Pacific coast trade of the Canadian Pacific Railway Co., left the Mersey for Vancouver. This vessel has been specially designed for the mining and cattle carrying trades between Vancouver and other Pacific ports. This vessel is also remarkable for her great beam in comparison with her length, her principal dimensions being: Length, 205 ft. overall; 38 ft. 2 in. wide, 24 ft. 10 in. deep from the spar deck, and her tonnage is 1,380 tons gross, and 867 net, and displacement 2,127 tons. At a draft of 17 ft. the vessel will carry a dead-weight of 1,450 tons, for she possesses a long uninterrupted main deck which will accommodate nearly 800 head of cattle, entrance to which is gained by wide port doors.

The long journey of the Princess Ena to Vancouver, it is expected, will

NEW FLAG DESIGNED FOR SUBMARINE BRANCH OF THE BRITISH NAVY.

are occupied by a submarine and three torpedoes. In each of the remaining quarters is a rampant white mouse, this being the first time that mice have been so honored. This is

[redacted]

ing saloon on the upper deck. This dining saloon is very large, being 84 feet long and the full width of the ship. The height of the apartment—ten ft.—makes it both light and airy. Revolving chairs are provided, and 330 persons can be accommodated at one sitting. The room is panelled out in best polished ash with teak mouldings, and the floor is covered with corticine. The sidelights are screened by sliding sashes fitted with co'ored obscure glass.

On the shelter deck two other large apartments—the smoking room and the ladies' room—are provided for the use of third-class passengers. The smoking room on the port side, is 50 ft. long 24 ft., wide, and over 9 ft. high. The ladies' room on the starboard side, is 50 ft. long, 20 ft. wide, and over 9 ft. high. Both are panelled out in polished ash with teak mouldings, are provided with revolving chairs, and are generally similar to the dining saloon, the floors being covered with corticine.

PROMENADE SPACE.

First-class passengers have an open-air promenade space 450 ft. long by 18 ft. wide on the boat deck, on each side of the vessel. On the promenade deck the space available for the outdoor exercise is 310 ft. long, by 18 ft. wide, on each side of the vessel. The space on the promenade deck, although open at the sides, is protected above, so that it can be used in wet weather. It will be seen,

[redacted]

tricity plays a large part in the culinary operations on board the vessel. The main cooking range, heated by coal fire, is 24 ft. long by 8 ft. wide. In addition, there are four large steam boilers, twelve steam ovens, three large electric grills, and various roasters driven by electric motors. The pantries are fitted with carving tables, bain maries, electric egg boilers, electric hot-plates, electric grids, and electric plate-washers. In the baker's shop there are numerous ovens and an electrically-driven dough-mixer. The confectionery room is fited with a long marble topped table, an ice-cream machine, etc., etc. Four electrically-driven knife-cleaning machines are provided in the room specially set apart for this operation. Lifts are arranged from the galley to the engineers' and officers' mess rooms on the deck above and to the storerooms below.

The third-class galley, on the shelter deck, is 48 ft. long, by 28 ft. wide, and is fitted with large cooking range, vegetable cookers, steam boilers, etc., etc. The galley is connected by means of a lift and a staircase with the third-class pantry below.

BATHS AND LAVATORIES.

The bath rooms and lavatories on board the Mauretania are interesting in view of their great size and the variety of marble introduced in their construction. The first-class baths are of Vit. enamel, with a white veined marble base. All are fitted

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There are several advantages in a longitudinally plated tank top viz.: Easier work in laying off on the mold system, obtaining better work and adding to the strength of the ship. The rivet holes connecting the tank top plating to the stiffening and plate floor angles can be made universal so that one mold is all that is necessary for marking the rivet holes in all the flanges to the tank top plating. The seam and butt straps may be marked from the tank top plates in place if there should be any doubt about the fairness of the holes. If the tank top plating is made parallel and square at the butts there is no fear of unfair holes as the bars and girders are all that have to be contended with.

The present system of cross butting the tank plating does not ensure so fair holes as the longitudinal method of plating even when the plates are templated from the

wash-basin tops are of St. Anne's marble and the fittings throughout are of white metal. Black and white tiling is laid in the lavatories on the upper deck, and in the lavatories on the shelter and promenade decks mosaic has been used.

In the third-class lavatories the baths are of Vit. enamel, the wash-basin tops are of St. Anne's marble, and the floors are tiled.

VENTILATION.

All the public rooms and state-rooms for first, second and third class passengers are ventilated by a system of air ducts, through which air is directed into each of the compartments by means of electrically driven centrifugal fans. The flow of air may be regulated at the will of the passenger into each cabin. In cold weather the air is suitably heated before being passed into the same series of pipes, etc. With regard to the lavatories, galleys, etc., the air is sucked from these spaces by electrically-driven fans. Thus it will be observed that the vessel can be efficiently ventilated should the side ports have to be closed through stress of weather. In fact air may be entirely changed throughout the ship at intervals of ten minutes.

During the building of the vessel, some 5000 men and lads were employed in connection with the vessel, on board, in the shipyard and in the engine works. It is estimated however, that at various times she provided employment for 8000 people in

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chased and gilt ormolu. By the use of clear glass panels in the doors, the range of view is much extended, reaching as it does to the beautiful corridors and adjoining spacious rooms, a total distance of about 350 ft.

FIRST-CLASS SMOKING ROOM.

The first-class smoking room, situated on the boat deck, can be reached by a lobby entering from the open-air promenade or through the lounge. The period selected for the decoration of this room is the same as that of the grand entrance and staircase, namely, sixteenth century, Italian; but it differs inasmuch as it is much richer in the carvings, and it is relieved round all the panels with an inlaid border of sycamore. An interesting feature is a jube extending the length of the room, divided into recesses, with divans and card tables. Two secluded recesses at one end of the apartment are fitted with writing tables. The windows in the recesses are of unusual size and of unique design for ship work. They have been successfully treated with semi-circular arches, giving the appearance of [illegible] old-fashioned sub-contractors' premises, rolling mills, etc., etc.

THE NAME MAURETANIA.

The directors of the Cunard Steamship Co., in selecting a name for the new vessel, have had recourse to classical times, and have chosen that borne by one of Rome's African provinces in the early days of Christianity. Mauretania extended over what is today Algeria and the northern half of Morocco. Its southern boundary was the lofty range of the Atlas mountains, which were believed by the ancients to support the heavens. East of Mauretania came the small provinces of Numidia and Africa, which are now more or less covered by Tunis. It is curious that the latter of these two little provinces has given its name in modern times to the whole vast continent. Many classical and medieval associations cluster round the name of Mauretania.

NEW STEAMER FOR THE GREAT LAKES.

On Sept. 4 the steamer Empress of Midland, built to the order of James Playfair, of Midland, Ontario, by Messrs. Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, for service on the Canadian lakes, left the Tyne to undergo her trials. This vessel, built to the highest requirements of the lake class under British corporation rules, is of the following dimensions: 252 ft. by 42 ft. 6¼ in.

THE SECOND-CLASS GRAND ENTRANCES AND STAIRCASES.

The second-class grand entrances, like the first-class entrance, extend from the main to the boat deck. These apartments are in specially selected teak, beautifully marked. The floors throughout are laid with rubber tiling, in a simple design of black and white, the latter color predominating. The grand and auxiliary staircases are in teak, similar to the entrances, and ascend from the main to the boat deck, thus giving access to all the second-class quarters.

THE MAIN DECK.

There are in all 70 second-class staterooms on the main deck, each accommodating two or four passengers. These cabins—as in most of the first-class rooms—are panelled in white, with mahogany furniture. Sofas, wardrobes and lavatory compactums are fitted; and here again the mirrors above the compactum and in the wardrobe doors have been so arranged as to give a double reflection. The wardrobes are also fitted with patent hinges, causing the doors to remain stationary in any [illegible] the first-draft of 19 ft. The machinery worked most satisfactory during the trials, a mean speed of about 11 knots an hour being attained. She took on her voyage across the Atlantic cargo which she loaded at Middlesborough.

ADVANTAGES OF SUBMARINE SIGNALING.

Five trans-Atlantic steamers which entered the port of New York in the thick fog that prevailed on Thursday and Friday, Nov. 21 and 22, report their experience with submarine signals. First Lieut. Poumlot, of the French Line steamship La Savoie ran into fog Friday morning when coming on the coast. At 11 o'clock he began listening for the submarine bell on Nantucket Shoals lightship; heard it clearly four minutes later, 45 degrees to port; he shaped his course accordingly, and ran for Sandy Hook, which bell he picked up at a distance of three miles, and entered New York harbor. After a year's experience Lieut. Poumlot says that all vessels should be equipped to receive submarine signals in order to protect them from disaster.

On the afternoon of the same day the Hamburg-American steamship Patricia got the Nantucket Shoals bell about 10 miles out, and was able to shape her course so as not to approach the light vessel nearer than 9 miles. The steamship Moltke also of the Hamburg-American line, leaving electric lights. A massive carved oak sideboard is a striking feature at the after end of the dining saloon, while immediately opposite is the piano. The tables, at which 250 persons can be seated, are also in oak. Brussels carpet runners of a bottle green are laid on the polished floors between the tables, and the revolving chairs upholstered in frieze velvet of the same color. The windows round the sides of the room are arranged in pairs; and the room generally has a light and airy appearance which is considerably enhanced by the lofty dome.

SHELTER DECK.

Some special second-class cabins may be seen on this deck, which, with their large square windows and other fittings, are only slightly inferior to the first-class staterooms. On the shelter deck the grand entrance extends over part of the dining saloon, and the passengers can walk round the balustrade and view the dining saloon below through the octagonal opening.

PROMENADE DECK.

On the promenade decks are the second-class drawing room and smoking room.

[illegible] five miles, and went on her eastward way.

The White Star steamship Baltic heard the Fire Island bell when 11 miles distant, and two hours later picked up Sandy Hook at about the same distance.

The Cunard steamship Mauretania, on her first trip, while feeling her way through the fog, heard the Sandy Hook bell at a distance of 12½ miles, and ran slowly up to the lightship. She heard the bell for an hour before she heard the whistle. Undoubtedly this vessel, with 9 tons of gold besides other cargo, represented the greatest marine risk that ever crossed the Atlantic. The sense of relief felt by a captain when he hears the sound of the submarine bell and is able to get direction exactly may be imagined. An air signal is uncertain; it is often absolutely misleading; it may be heard at 5 miles and lost at 2 miles; but such distances as the five steamships report on Friday last cannot be possibly equaled by the best air signals ever invented.

The W. & A. Fletcher Co., Hoboken, N. J., is fitting the new propeller ferry boat, Perth Amboy, recently completed at New London, for service between Perth Amboy, N. J., and Tottenville, L. I., with her machinery. The vessel, which is a very modern one, has been constructed at a total cost of $90,000.

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NEW C. P. R. STEAMER.

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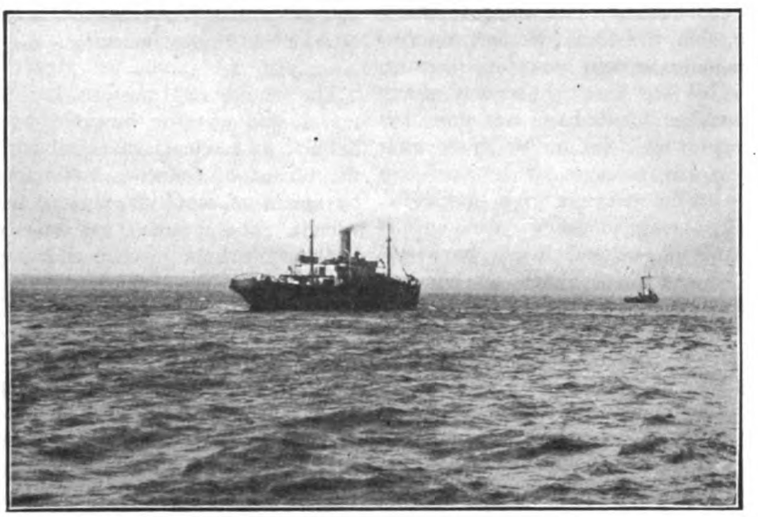
The long journey of the Princess Ena to Vancouver, it is expected, will take 60 days. She has been specially equipped for the voyage and carries 1,000 tons of coal. She will put into Montevideo on her passage for a further supply of coal.



PRINCESS ENA—AN ENGLISH-BUILT STEAMER FOR PACIFIC COAST TRADE OF THE C. P. R.

NEW BRITISH SUBMARINE ENSIGN.

The accompanying illustration is a reproduction of the center piece on the new flag designed for the submarine branch of the British navy by Lieut. R. G. Hervey, of H. M. S. Mercury. The flag measures 18 ft. by 12 ft., its background being in three vertical sections colored yellow, red, and blue.

In the center is a black shield, divided into four parts, two of which are occupied by a submarine and three torpedoes. In each of the remaining quarters is a rampant white mouse, this being the first time that mice have been so honored. This is the flag mentioned in the Notes and Comments of the October Engineer's number.

NEW FLAG DESIGNED FOR SUBMARINE BRANCH OF THE BRITISH NAVY.

The Frederick A. Verdon Co., West New Brighton, R. I., has just started the work of construction on the vessel which it is to build for the department of charities and correction of the city of New York. This vessel is to be 131½ ft. long, 27½ ft. beam and 11 ft. deep.

Burgess & Packard, Marblehead, Mass., are preparing plans for an 88-ft. steamer for the Augusta, Gardiner & Boothbay Steamboat Co., which will have a carrying capacity of about 300 passengers. The new boat will be named Islander.

LAKE SHIP YARD METHODS OF STEEL SHIP CONSTRUCTION.

By Robert Curr.

It will be seen that the Toledo Ship Building Co. adheres to the longitudinal plating of the tank top which is almost dispensed with on the great lakes.

There are several advantages in a longitudinally plated tank top viz.: Easier work in laying off on the mold system, obtaining better work and adding to the strength of the ship. The rivet holes connecting the tank top plating to the stiffening and plate floor angles can be made universal so that one mold is all that is necessary for marking the rivet holes in all the flanges to the tank top plating. The seam and butt straps may be marked from the tank top plates in place if there should be any doubt about the fairness of the holes. If the tank top plating is made parallel and square at the butts there is no fear of unfair holes as the bars and girders are all that have to be contended with.

The present system of cross butting the tank plating does not ensure so fair holes as the longitudinal method of plating even when the plates are templated from the ship.

The butt strap of the cross plated tank is composed of a 9-in. channel riveted to the floor plate and any wrong fitting of this channel affects the holes the whole width of the plate the distance between the rider and tank margin plate.

In the other arrangement only the holes on the stiffener flange the width of one plate may be affected.

In the case of the longitudinally plated work the plating is only reduced in area by the punching of the rivet holes for the stiffeners.

Under tension the cross plated work is entirely depending upon the rivets which do not compare with the solid plate less the rivet holes.

Seam straps are fitted for connecting the longitudinal seams together which add to the stiffness of the plate between the girders and it seems that there are less indentations in the tank top of the longitudinally plated vessels.

Another feature in this company's construction at the hatches is the advantage in loading and unloading the vessel.

Instead of the arch plate being in line with the hatch opening it is fitted between the hatches and bracketed to the deck plating, thus removing obstacles which very much interfere with the unloading of the vessel.

This arrangement leaves the opening of the hatches clear under the coamings and the vessel's structure remains whole and unaffected with buckets as is the case where any material hangs down under the deck and in line with the hatch openings.

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The spar deck plating seams are lapped on the beams, the plates running across ships. This practice is adopted by all the ship builders on the lakes as it saves rivets and makes a fairer deck.

At one time it was quite troublesome in keeping the deck fair when the plates were fitted fore and aft. Angles were fitted on the seams and all kinds of contrivances were adopted to keep the deck plating seams straight and prevent the plates from sagging between the beams.

The line of the hatch openings terminates the value of the deck plating as far as the resisting of tension and compressive strains are concerned so that the deck plating between the hatches may be considered as a floor and of little importance in assisting the vessel in resisting these strains.

The rivets connecting the seams together and hatch coaming to the deck plating never exceed nor are closer than six diameters of the rivet which is found ample for watertight work.

Riveting. The keel strake landings are 6 in. wide, double riveted with inch diameter rivets. Butts single strapped and quadruple riveted with inch diameter rivets.

Strakes A, B, C, F and G have double riveted seams 5¼ in. wide and treble riveted lapped butts connected together with ⅞-in. diameter rivets excepting the butt laps on A strake, which are quadruple and the seam next keel plate 6 in. wide and connected with inch diameter riveting. Strakes D and E have quadruple riveted lapped butts and the seam connecting same together have 1-in. diameter riveting 6 in. wide.

The top seam of G strake is connected to H strake with inch diameter rivets, 6 in. wide. H strake is connected to the sheer strake with inch diameter rivets treble and the lapped butts are quadruple riveted 1-in. diameter.

The sheer strake riveting is 1-in. diameter, the seams treble riveted and butts double strapped, the inside strap quadruple and outside treble riveted.

All other butts of shell plating are lapped and triple riveted ⅞-in. diameter rivets and at ends ¾-in. diameter rivets.

Butts of spar deck stringer, both courses, are double strapped, quadruple riveted on the inside and triple riveted on the outside with inch diameter rivets for three-quarter length of vessel. Butts of stringer at ends single strapped and triple riveted with ⅞-in. diameter rivets.

Butts of seam straps between courses double strapped and triple riveted with 1-in. diameter rivets. All inch diameter rivets in seam strap. Deck plating lapped on stringer and double riveted with ⅞-inch diameter rivets.

Butts of center keelson and longitudinals lapped and triple riveted with ¾-in. diameter rivets.

Main deck stringer butts lapped and triple riveted with ¾-in. diameter rivets, double riveted at the ends.

Butts of rider plate triple riveted with ¾-in. diameter rivets.

Seams and butts of tank top plating double riveted ¾-in. diameter rivets edge and edge plated. Butts and seams of side tank lapped and double riveted with ¾-in. diameter rivets.

All other rivets governed by the thickness of the material connected together.

All rivets completely fill the holes, their heads are carefully laid up and their points never below the surface of the plating where countersunk. Care is taken where the holes are not punched from the faying surface to have them smooth so that the material will be a close fit. Countersinking to pass nearly through the full thickness of material; 85 per cent of the riveting is done by machines and this firm is up-to-date in every respects in the lake practice of ship building.

Those who may feel interested in following up the technical part of ship building will find, know your own ship; a simple explanation of the stability, construction, tonnage and freeboard of ships by Thomas Walton, naval architect, very useful, and covers all that is desired on the various calculations of a ship on the great lakes.

This book is sold by the MARINE REVIEW and is always on file in their office.

ATLANTIC COAST GOSSIP

Office of the MARINE REVIEW,
1005 West Street Bldg.,
New York City.

The storm which raged along the Atlantic coast in the early part of the week was but the forerunner of things to come in the bleak winter months. Although no serious maritime disaster or loss of life resulted, reports show that considerable damage was done by the heavy seas among shipping and to coast structures.

One of the heaviest fogs that New York has seen in many years enveloped the upper and lower bays on Monday, completely tying up shipping and disorganizing harbor traffic generally.

Owing to having been compelled to slow down for heavy weather, the Cunarder, Mauretania failed to equal the Lusitania's westbound record by 10½ hours. As she made a record, however, of 624 knots for one day's steaming, it is expected that she will in time hold all records.

On her last eastbound run the Lusitania broke her own record by just three minutes, making the distance in four days, 22 hours and 50 minutes.

The steamship Massapequa of the New York and Porto Rico Steamship Line, has arrived a San Juan with the Buenos Aires, of the Spanish Trans-Atlantic Line.

The Massapequa picked up the Buenos Aires between Ponce and Mayaguez, the latter vessel being helpless through a broken shaft.

It is rumored in shipping circles that the Cunard Line contemplates an alteration in the sailing of the Lusitania and Mauretania by which the vessels will leave Liverpool earlier in the day on Saturday, call at Cherbourg for continental passengers, and thence to Queenstown. From Queenstown they will sail Sunday afternoon, arriving at New York Friday morning.

The Hamburg-American Line is to try a ship gyrator invented by Otto Schlick, an engineer of Hamburg, with the object of reducing rolling at sea by means of rapidly revolving balance wheels. The company has ordered the Vulkan Works at Stettin to equip the North Sea steamer Silvana with these gyrators.

Mrs. Ida Lewis Wilson, keeper of Lime Rock Light, in Newport Harbor, has been notified by Andrew Carnegie that he has placed her on his private pension list, insuring her a pension of $30 a month for her lifetime. Mrs. Wilson, or Ida Lewis, has received many honors for her heroism in saving lives in Newport Harbor, the City of Newport and the Narragansett Yacht Club being amongst the donors.

Lightship No. 88, built by the New York Ship Building Co. for the government, made a most successful trial trip on the Delaware on Nov. 21. She will be named Columbia River, No. 88, and will be stationed at the mouth of Columbia River, Ore.

Capt. Schierhorst, of the German steamer Phoebus, which arrived at New York from Hamburg and Shields, reports destroying the abandoned Dutch schooner Anna in midocean. The derelict, the hold of which proved to be filled with dried fish, was set on fire.

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The lighthouse board announces two important changes in the aids to navigation. About Dec. 3 the intensity of the Montauk Point light is to be increased by changing the illuminant from oil to incandescent oil vapor. While the intensity of the flash will be increased, its duration will be reduced from nine-tenths to four-tenths of a second. Fire Island Light, at the easterly side of Fire Island inlet and 67 miles to the westward of Montauk Light, will also be increased in intensity on the same date. The duration of the flash will be reduced to four seconds and the dark interval to 56 seconds.

Because of the unprecedented rush of foreigners bound for European ports, serious freight congestion threatens all foreign shippers. At this season of the year freight traffic is always heavy, and the unexpected demand for steerage accommodation is causing some considerable difficulty in handling both freight and passengers. The eastward-bound steerage, or third-class, travel for the year 1907 is already 110,000 in excess of the same period of 1906, and the second class 14,000.

The petroleum exports from Philadelphia during the past week aggregated over 10,000,000 gallons, all of which was carried in bulk oil freighters, both steam and sail craft. The total exports since Jan. 1 have been 383,000,000 gallons.

It is officially announced that quarantine against Cuban ports is now ended, with the exception that passengers from such ports, must, if intending to proceed south after landing, furnish United States Marine Hospital official in command with their future addresses.

The enlisted men of the 16 battleships of the Atlantic held a farewell ball at Coney Island, on the evening of Nov. 29. The men in charge of the ceremonies are from the Connecticut, Louisiana, Rhode Island, Alabama and Ohio, the supply ship Glacier, and the repair ship Panther, the seven vessels of Admiral Evans' fleet now at the New York navy yard.

The scout cruiser Salem will be placed in commission about next June, and will be commanded by Lieut. Com. A. L. Key. Her sister ship, the Chester, of which Lieut. Com. T. S. Wilson will be in command, will probably be commissioned in April.

CURRIE'S MANNERS.

BY JAMES ROSSAN.

The first of the dangerous storms of autumn was sweeping the lakes. It was only a good half gale, yet it brought its ominous message as a harbinger of what was to come. The large, staunch freighter Monarch was bucking into it. The men out on deck dodged the spindthrift thrown into the backstays and pronounced it a dirty night. But below decks they said it was beautiful steaming weather, cold and clear, with a full draft breeze. The steam gage hung glued to the spot, and the Monarch stood north'ard on Gitchie Gumee to the tune of 90 to the minute.

The second engineer, who had charge of the watch, sat contentedly in his chair within easy reach of the levers, while over on the port side, where the best view was obtainable of the watergage glasses, the oiler paced lustily up and down whistling "Bonnie Jean." The rapid opening and closing of the steamports, and the weak complaint registered by each crankcenter, all distinctly audible to the practiced ear, resolved itself into a hum attuned to the beat of 90 to the minute. Even the step and the tune of the oiler fell into the rhythmic beat of the engine.

Then a discord entered. It was a short, sharp click at the throttle followed by several nasty jars at the H. P. and F. I. valve gears. The rhythm and harmony was disturbed, and instantly the "second" sprang to the levers, while the oiler raced for the lower floor. Currie, who was the chief engineer, came down the stairway on the jump.

The disturbance had now settled down to a steady thump whenever the L. P. engine took the bottom center. From below the oiler reported the rapid heating of the L. P. pin and adjacent journals. The "second" had partly closed the throttle, and asked a hasty, "Shall I stop her, sir?"

"No!" came sharp and decisive; "we can't stop in weather like this."

The speed was now reduced, and the order rang through the engine-room for all hands to stand by. Next the chief, with the assistance of several of the handiest men and much ingenuity, managed to slack the troubled journals without being ground to pulp by the moving crank. Several lines of hose were then laid and streams of cold water applied to the heated parts. Trouble never comes singly and it was not long before it started to show at the H. P. and F. I. pins. More lines of hose were laid, and more shivering, dripping individuals stood down there with the cranks slashing the cold water all over them.

And now there was work for everybody and to spare. Special oils were compounded, and mixed with powdered sulphur they were applied in liberal doses. Kerosene oil and soapsuds were resorted to. And in the grease cups it was graphite and cylinder oil, with a portion of white lead added. Economy on lubrication was thrown to the winds; it was a matter of efficiency now. The refractory bearings were palmed every few minutes in order to keep a close tab on what they were doing. Everybody was busy. The orders came from the "chief" in that sharp, commanding voice which brooked no hesitation. And there was no indication of a respite in the near future. For those engines, which only a short time ago had hummed so merrily along to the tune of 90 to the minute, were now thumping, and slamming, and jerking at the mournful gait of 60 to the minute and anything beyond that brought smoky distress signals from below.

But I have gotten ahead of my story, and must revert back two trips. At that time there was friction aboard the Monarch, and it happened in the following manner. It was one of those trips when through the agency of overcrowded docks the Monarch had a few days' delay. This was something which occurred but seldom, so it seemed as if nearly everything aboard needed overhauling. The air pump was opened up for inspection; so was the feed pump and the ballast pump. Slack was taken up on crank pins, journals, and crosshead-shoes, and the port boiler was cleaned. Of course, this was all necessary work and the men pitched in with a will, and when the end was finally reached they still had the better part of a day in which to attend to their own little affairs. It was then, while gathering up the tools, that an oiler reported a small steel kerosene torch missing. An incipient search was started for it without results. It was renewed on a larger scale, and still no results. Then the "chief" placed himself at the head of the searching party, composed of the full crew, and still that cantankerous torch remained conspicuous by its absence. The air pump cover was lifted again, so was that of the feed pump, and the ballast pump, but no torch was found. As a few hours remained before sailing time the "chief" began speaking of blowing down the port boiler and opening her up. But the limit of endurance was reached. Angry

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mutterings were heard among the men. Out in the stokehold they gathered and they were loud in their condemnation of the superior officer. That a man could be so confounded penurious as to work a whole crew of men the better part of a day in search of a measly old torch which could be bought for 15 cents seemed quite beyond belief. And the unanimous decision was that they were not going to stand for it any more. Even the assistants were disgusted with the whole proceeding, and were not slow in informing the "chief" of the men's stand.

It was then Currie assumed the role of the politician, threw caution to the winds, and said: "That'll do, boys; that torch is lost!"

The Monarch was a snug berth, and the men all stood by, but things were not the same. The harmony was disturbed. The men gathered clannishly in small groups, and the topic under discussion was invariably the miserable meanness of their "chief." Of course, each man did his duty, but those little pleasantries, and little helpings which lighten the burdens of the labor were absent.

The assistants worked under the leash of the sharp eye of the "chief." They vented their spite on the oilers, who in turn took it out on the stokehold force.

Thus matters stood at the time of the incident on Lake Superior. Now, let it be chronicled right here that at this strenuous time no man shirked his duty or showed signs of flinching.

Whatever they were, they were not men to stand back when duty called. They were steamboatmen, and this was only one phase of a steamboatman's life. All night they kept it up, with all hands standing by, and all the next day, and all the next night. They would have kept it up for days and nights to come; but the harbor was reached, and no man had slept for 36 hours, and no man had dry stitch on him. They gathered their consolation from the fact that they had driven their boat to her destination without placing her in jeopardy through the stopping of the engines.

Luckily for the Monarch, her ore was not in the pockets, and was slated for a night in. The cause of the trouble had been discussed liberally among the crew, and it ranged all the way from a warped cylinder to a broken crank pin.

Currie immediately ordered the bottom head of the L. P. cylinder lowered. As it swung down in its tackle, he reached in and picked off several pieces of flattened steel, hammered and battered to a bright polish. He threw them viciously on the floor with the words: "There's the torch you left in the port boiler!"

Upon further examination it was found that the torch in passing through had caught in the ports of the H. P. and F. I. P. engines. This had slipped the set screws of the clamps holding the valves in position on the stems. Consequently the valves were dislocated, causing the engines to work very badly.

It was well into the small hours of the morning ere temporary repairs were made, and the men went to a brief and well-earned rest.

After breakfast they were all on hand again, and Currie received the surprise of his life to find them all lined up in the engineroom. The "second," who stood at the end of the line nearest the door, threw a pleasant: "A fine morning to ye, sir!" at him, with a heavy accent on the "sir." There is such a vast difference in the way that "sir" is tacked to the end of a sentence. In the hands of the average steamboatman it can be made to express the whole gamut of human feelings from contempt to respect. And the one which fell on Currie's ears certainly expressed both the height of admiration and the profoundest of respect.

The "second," with the assistance of several of the smartest among them had prepared a neat little speech. But now, while in the awful presence, he had completely forgotten every word, and could only stammer forth: "There's a bit we have to say to ye, sir!" and then his voice failed him again.

"Oh, about that torch; well, that's all right!" Currie answered him in an off hand way, with a motion to the men to depart, as if the incident was closed.

But not a man moved, and presently the "second" found his voice again and blurted out: "It is I, as have been a thinkin'; and the men as have been a sayin', as how we've been a actin' meaner'n a lot o' skunks there last two trips back."

Currie cast a glance over that row of contrite faces, and then he grasped a golden opportunity. He was a man with whom the matter of being particular about the small things was almost a hobby; and he did love to talk on the subject.

This opportunity, with its practical lesson to draw on, seemed to him a bountiful compensation for the hardship endured.

He faced that humiliated row and spoke long and eloquently. He cast one retrospective eye back to the apparently insignificant loss of the torch. He let another wander into the future and dwell on the large bills which would be forthcoming for extra oils and grease and sundry repairs. He concluded with the remark that he felt it was all for the best, because they had paid dearly for their oversight, and he doubted not that the lesson would remain by them the rest of their lives.

After the ordeal was over the men swung into the regularity of their work again, each one of them ready to swear that he worked for the best, the fairest, the ablest, the smartest "chief" who ever drove boat to the head of the lakes. Once more all things swung along in harmony. Once more those coarse pleasantries and ribald jokes, which serve to lighten the labor, rang out above the machinery's din. Once more the jolly tune of "Comrades, comrades, ever since we were boys," resounded through the engine room of the Monarch.

Even the "chief," as he walked up town to sign large bills which he knew he would hear from later from the office, fell into the merry tripping step which comes from a light heart, and found himself softly humming, "There's a better day a coming."

GRAPHITE IN MOTOR BOAT LUBRICATION.

A gritless graphite powder is prepared by the United States Graphite Co. of Saginaw, Mich., from the product of their own graphite mines in Mexico and by them combined with pure mineral oils of proper gravity in just the right proportions to make ideal lubrication for motor boats. The resulting grease, which is made in four consistencies (or densities) ranging from a "non-fluid oil" to a hard grease, is absolutely uniform, gritless, dripless and free from precipitation. It can be used wherever oil is ordinarily used and is much more efficient. Furthermore a great saving is at once noticeable, also total absence of drippings, and it is astonishing how far a 10-pound can of it will go. It is impossible to mix by hand and at random any dry material with oils of indifferent quality and secure the same satisfaction which must result from perfection in mixing by machinery and the accurate proportions of a carefully worked out formula. To introduce it the manufacturers will send once only a 35-cent can on receipt of 20 cents in stamps to pay postage and dealer's name.

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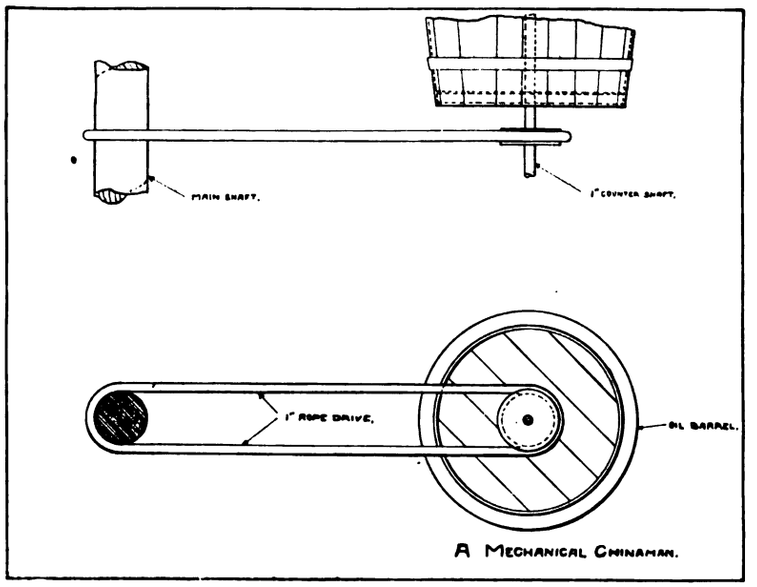
A MECHANICAL CHINAMAN.

A simple device, which would be a welcome addition to many engine rooms, is shown in the sketch. Many stationary, and all marine engineers and firemen have some washing to do. Second engineer Laux, of the steamer S. N. Parent, mounted an oil barrel upon an inch shaft running in bearings screwed to the engine room floor. A handhole is cut in the side of the barrel, and a cover, made with a clamp on the inside, is drawn up with a bolt and thumb screw. A pulley was keyed into the barrel shaft, and the bare main shaft of the steamer was the power. A leather or rubber belt would have been useless, as the main shaft is always wet, and more or less water is flying about the hold. The only effect of this upon the inch rope used, is to tighten it. Indeed, if it does run loose, a drenching with the hose is all that is necessary. The efficiency of the "Chinaman" may be increased by fitting the inside of the barrel with wings.



A MECHANICAL CHINAMAN.

SHIP YARD NOTES

Charles H. Curtis & Co., Ellsworth, Me., will soon resume work on a 60-ton schooner, the keel of which was laid early in the fall.

The Neafie & Levy Ship & Engine Building Co., Philadelphia, Pa., launched the steel tug Adriatic last week. The tug is 84 ft. long, 20 ft. beam and 10½ ft. deep. She is owned by P. F. Martin.

Theodore Knudsen, a former great lakes ship builder, has embarked in the ship building business at South Portland, Ore., having already erected ways, and intends to install a dock and marine railway.

William Cryer, East Oakland, Cal., has a twin-screw gasoline tug boat under construction for the Southern Pacific Railway Co., which is to be fitted with two engines of 75 H. P. each. The vessel will cost about $15,000.

The Moran Co., Seattle, Wash., has had the steamship Cottage City, owned by the Pacific Coast Steamship Co., San Francisco, on the ways for a survey, she having lost her tailshaft recently in Alaskan waters. Bids will be called for for effecting repairs to the vessel.

The James Clark Co., Baltimore, Md., has been awarded contract for remodeling the B. C. & A. Railway Co.'s steamer Old Point Comfort. Twenty-six state rooms will be added, William E. Woodall & Co. having contracted for the joiner work.

The Erie Basin Dry Dock Co., Brooklyn, N. Y., will effect the rebuilding of the Merchants & Miners Transportation Co.'s steamer Allegheny, which was almost destroyed by fire several months ago. She will be converted into a freighter and is to be completed in 100 days.

The Maryland Steel Co., Sparrows Point, Md., has been awarded contract for the boiler, engine, iron work and all necessary sea equipment for the tug now building by Thomas McCosker & Sons, at Baltimore for the P. Dougherty Towing Co. This vessel is 136 ft. long, 27 ft. beam and 14 ft. depth of hold.

Cobb, Butler & Co., Rockland, Me., have closed contract with Crowell & Thurlow, of Boston, for the construction of a four masted schooner, to be 179 ft. keel, 39 ft. beam and 14 ft. depth of hold. She is to be named Lewiston. Work will be begun on the frame about the last of January.

The Electric Boat Co. has been awarded a contract by the secretary of the navy for the construction of seven submarine boats to cost $2,270,000. The craft will be built at the plant of the Fore River Ship Building Co., Quincy, Mass., and work will be started on them at once.

The Greenport Basin & Construction Co., Greenport, N. Y., successfully launched the oyster steamer M. P. McDonagh, Nov. 21. The vessel is owned by Lowndes & Mills and is 75 ft. long, 20 ft. beam and 6 ft. deep and will carry 3,500 bu. of oysters. The McDonagh is fitted with a 100-H. P. gasoline engine.

Crawford & Reid, Tacoma, Wash., have begun work on the construction of a staunch little craft for use as a cannery tender for the Russia Cement Co. She will be 71 ft. long, 13½ ft. beam and 6 ft. deep, and will be fitted with a 65 H. P. gasoline engine. She will be launched about the first of the year.

The Halifax Dry Dock Co., Halifax, N. S., have recently acquired the steamer Universe from the underwriters and have started repairs, which will involve the replacing of 120 plates and the erection of a new stern frame. It is estimated that the repairs will cost her new owners about $50,000.

The Bath Iron Works, Bath, Me., is to build the machinery for the new steamer Islander, building for the Augusta, Gardiner & Boothbay Steamboat Co., W. I. Adams, of Boothbay, Me., having the contract for building the hull. She will be 88½ ft. long by 19½ ft. beam and 7 ft. deep and will accommodate 300 passengers.

The Fore River Ship Building Co., Quincy, Mass., launched the steamer Altamaha, building for the Brunswick Steamship Co., on Nov. 26. This is the fifth vessel built at that yard for the Brunswick Steamship Co., which operates a line of steamers from New York to Brunswick, Ga., and Jacksonville, Fla. The Altamaha, like the four vessels which have preceded her, is 312.9 ft. in length, 40 ft. beam and 27.7 ft. deep.

The steamship Tampico, owned by the Pacific Coast Steamship Co., San Francisco, Cal., which was damaged by striking the rocks recently, has been out on the ways at Hall Bros.' plant at Port Blakely, Wash., for the purpose of having a survey made. Bids will be called for for effecting the repairs which will include the renewal of 24 plates, the fairing of five others, and the repairing of 65 frames, two bulkheads and the water bottom.

Capt. G. L. Cuddeback, of the steamer R. E. Schuck, is seriously ill at his home in Lorain.

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THE PRESIDENT'S MESSAGE.

The message of the president of the United States gives us hope; but this is not saying much, for hope is a fountain fed by eternal springs. The message does not revive hope since hope is never extinguished, but it nevertheless gives buoyancy and color to it. In this particular instance the president has approached the shipping question in a manner to which none can except. His argument carries conviction with it. Is it unanswerable. Subsidy and the fear of private gain are all put aside. He pleads for a simple extension of the ocean mail act of 1891, and proves conclusively that our facilities for delivery of over-sea mail are inadequate on account of lack of suitable steamships.

If a nation should be self-contained in any way it certainly should be in the interchange of communications. The greatest privation that the pioneers of this country endured was the absence of word from their families over long periods of time owing to the lack of means of communication. Consider what it must mean to a nation to be deprived of mail facilities; and yet that is precisely the situation in which the United States is today. The president indicates the remedy. He shows that the net profits of the ocean mail service are annually over $3,500,000—a sum sufficient, if intelligently applied, to project mail routes in places where they are now lacking. In other words, an adequate service can be performed without any cost to the people whatever, to say nothing about the subsidiary benefits that would be bestowed upon the whole people by the revival of so important an industry as ship building.

The bill which was filibustered to death in the senate last March simply provided for the extension of the ocean mail act of 1891 by the projection of four additional mail routes. The president probably had that bill in mind when he wrote his message and his words must be taken as a desire to have that measure passed. His exact language follows:

> I call your especial attention to the unsatisfactory condition of our foreign mail service, which, because of the lack of American steamship lines, is now largely done through foreign lines, and which particularly so far as South and Central America are concerned, is done in a manner which constitutes a serious barrier to the extension of our commerce.
>
> The time has come, in my judgment, to set to work seriously to make our ocean mail service correspond more closely with our recent commercial and political development. A beginning was made by the ocean mail act of March 3, 1891, but even at that time the act was known to be inadequate in various particulars. Since that time events have moved rapidly in our history. We have acquired Hawaii, the Philippines, and lesser islands in the Pacific. We are steadily prosecuting the great work of uniting at the isthmus the waters of the Atlantic and the Pacific. To a greater extent than seemed probable even a dozen years ago, we may look to an American future on the sea worthy of the traditions of our past. As the first step in that direction, and the step most feasible at the present time, I recommend the extension of the ocean mail act of 1891. That act has stood for some years free from successful criticism of its principle and purpose. It was based on theories of the obligations of a great maritime nation, undisputed in our own land and followed by other nations since the beginning of steam navigation. Briefly these theories are, that it is the duty of a first-class power so far as practicable to carry its ocean mails under its own flag; that the fast ocean steamships and their crews, required for such mail service, are valuable auxiliaries to the sea power of a nation. Furthermore, the construction of such steamships insures the maintenance in an efficient condition of the shipyards in which our battleships must be built.
>
> The expenditure of public money for the performance of such necessary functions of government is certainly warranted, nor is it necessary to dwell upon the incidental benefits to our foreign commerce, to the ship building industry, and to ship owning and navigation which will accomplish the discharge of these urgent public duties, though they, too, should have weight.
>
> The only serious question is whether at this time we can afford to improve our ocean mail service as it should be improved. All doubt on this subject is removed by the reports of the postoffice department. For the fiscal year ended June 30, 1907, that department estimates that the postage collected on the articles exchanged with foreign countries other than Canada and Mexico amounted to $6,579,043.48 or $3,637,226.81 more than the net cost of the service exclusive of the cost of transporting the articles between the United States exchange postoffices and the United States postoffices at which they were mailed or delivered. In other words, the government of the United States, having assumed a monopoly of carrying the mails for the people, is making a profit of over $3,600,000 by rendering a cheap and inefficient service. That profit, I believe should be devoted to strengthening our maritime power in those directions where it will best promote our prestige. The country is familiar with the facts of our maritime impotence in the harbors of the great and friendly republics of South America. Following the failure of the ship building bill we lost our only American line of steamers to Australasia, and that loss on the Pacific has become a serious embarrassment to the people of Hawaii, and has wholly cut off the Samoan islands from regular communication with the Pacific coast. Puget sound, in the year, has lost over half (four out of seven) of its American steamers trading with the Orient.
>
> We now pay under the act of 1891 $4 a statute mile outward to 20-knot American mail steamships, built according to naval plans, available as cruisers, and manned by Americans. Steamships of that speed are confined exclusively to trans-Atlantic trade with New York. To steamships of 16 knots or over only $2 a mile can be paid, and it is steamships of this speed and type which are needed to meet the requirements of mail service to South America, Asia (including the Philippines), and Australia. I strongly recommend, therefore, a simple amendment to the ocean mail act of 1891 which shall authorize the postmaster general in his discretion to enter into contracts for the transportation of mails to the republics of South America, to Asia, the Philippines, and Australia at a rate not to exceed $4 a mile for steamships of 16 knots speed or upward, subject to the restrictions and obligations of the act of 1891. The profit of $3,600,000 which has been mentioned will fully cover the maximum annual expenditure involved in this recommendation, and it is believed will in time establish the lines so urgently needed. The proposition involves no new principle, but permits the efficient discharge of public functions now inadequately performed or not performed at all.

Concerning the navy department, it is a pity that Roosevelt, who is more familiar with that department by inclination and training than any president we have ever had, should not have looked the facts more squarely in the face. He refers to them, of course, but simply by inference. He says:

> But it is idle to build battleships unless in addition to providing the men and the means for thorough training, we provide the auxiliaries for them, unless we provide docks, the coaling stations, the colliers and supply ships that they need. We are extremely deficient in coaling stations and docks on the Pacific and this deficiency should not longer be permitted to exist.

In our opinion the president should have emphasized the collier as the great deficiency. A coaling station, which is presumably a dock, is a necessary thing, but it is useless without coal. The collier makes it efficient. Again the president says:

> The battle fleet is about starting by the Straits of Magellan to visit the Pacific coast. Sixteen battleships are going under the command of Rear Admiral Evans while eight armored cruisers and two other battleships will meet him at San Francisco, whither certain torpedo destroyers are also going. No

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fleet of such size has ever made such a voyage and it will be of very great educational use to all engaged in it. The only way by which to teach officers and men how to handle the fleet so as to meet every possible strain and emergency in time of war is to have them practice under similar conditions in time of peace. Moreover, the only way to find out our actual needs is to perform in time of peace whatever maneuvers might be necessary in time of war. After war is declared it is too late to find out the needs; that means to invite disaster. This trip to the Pacific will show what some of our needs are and will enable us to provide for them. The proper place for an officer to learn his duty is at sea and the only way in which a navy can ever be made efficient is by practice at sea under all conditions which would have to be met if war existed.

In this paragraph the president overlooks a mighty important fact. That fact is that in time of war this particular maneuver could not be made at all. It is not only proper but it is extremely wise to practice in time of peace those maneuvers which must be made in time of war; but there is no sense in practicing maneuvers which cannot be performed when they are needed. The succeeding sentences, however, are qualifying. The president probably had colliers in mind when he wrote that after war is declared it is too late to find out our needs and that the trip to the Pacific would show what some of our needs are and will enable us to provide for them. If this trip actually will enable us to provide for them, it will be worth a hundred times more than it will cost; but the present maneuver could not have been made without the assistance of Great Britain, and it might awaken the country to a realizing sense of its own impotence if the president of the United States would flatly say so.

VERTEBRATE PROPELLER BOAT.

As each new idea in the way of a labor, time, or money saving device puts in an appearance, the average person interested is usually struck with its great simplicity. In fact, the device in his opinion is so simple that he is surprised to think the idea should have escaped his attention. It has fallen to the lot of a New Yorker, however, to devise a method of propelling a boat by practically reproducing in the propelling apparatus the action of a swimming fish. This does not apply to the movement of the tail of the fish alone, but to the whole body. The inventor, after several years of experimenting, has perfected a model boat with what he terms a vertebrate propeller, and experts have agreed that the device bids fair to revolutionize the methods of marine propulsion.

This vertebrate propelling machinery consists of a series of flat plates, hinged together, working horizontally along the bottom of the boat. Two keel plates fitted vertically on either side of this sinuous line of plates ensure the water set in motion being driven direct towards the stern of the boat. The motion is imparted to the plates by rods passing through the bottom of the boat and having their ends attached to the hinge pins. The upper ends of the rods are attached by connecting rods to a crank shaft coupled to the engine, the four cranks being set at an angle of 45 degrees. When in operation, the motion imparted to the plates is similar to the swimming of a fish, both sides of the propeller exerting the same force in thrusting against the water.

We had an opportunity of inspecting the model under way in the 30-ft. tank at the headquarters of the inventor, the boat—about six feet in length and built of metal—traveling the entire length of the tank in about four seconds. The full power of the clockwork machinery exerted at the start was not maintained throughout the entire trip, but the ability to travel displayed by the model was sufficient proof of the fact that there are great possibilities in the vertebrate propeller.

A 50-ft. boat is now being completed, decked fore and aft, in which will be installed a 75-horsepower engine to drive the propeller, and great things are expected of the new comer.

The idea of applying the action of a swimming fish to propel craft through the water belongs to Joseph Turner, of New York.

THE HONORABLE PETER WHITE.

Orders may now be sent to the MARINE REVIEW for the second edition of the book entitled "The Honorable Peter White." It is now on the press and will be out of the bindery in about 10 days, in ample time to be delivered anywhere in the United States for the Christmas trade. The first edition of this work met with such instantaneous success that the publishers resolved to greatly enlarge the scope of the second edition, embracing much new matter that had been discovered since the first edition was published and much that has also transpired since it was published. For instance, the new matter includes an account of the celebration at Sault Ste. Marie upon the completion of the first half century of the canal's usefulness.

The book of the second edition is nearly twice as big as the one of the first, containing among other things nearly 100 extra pages of pictorial matter alone. The purpose of writing this book was to put in an imperishable form an authentic history of the development of the great iron deposits of the Lake Superior country while it was yet possible to do so. The record has been obtained from the men that actually took part in the discovery and initial development of the iron mines. So vast indeed has been the progress of this industry, and so stupendous its results in the creation and distribution of individual wealth, that it seems incredible that it should have occurred within the lifetime of one man. Yet it is so. One man was there at the beginning and he is there yet—the Hon. Peter White of Marquette. He assisted in stripping the first iron mine developed in the Lake Superior country and it has seemed just to incorporate the story under his name, so universal have been his activities in this great industrial theater. The story as told is of uncommon interest to the iron world; in fact the history of iron manufacture in the United States is not complete without it since three-fourths of all the iron that is made in this country is smelted from ores that come from the Lake Superior mines. Incidentally there is detailed the development not only of the mines but of the whole problem associated with the transportation of the ore. The growth of both docks and ships is faithfully followed. Good fortune has attended the publishers in procuring not only photographs of the earliest ships used in the transportation of ore, but also of the earliest docks and earliest types of unloading machines. It is therefore possible to follow the development of the unloading machine from the wooden tub to the automatic clamshell buckets capable of grabbing 12 tons of ore at a time.

In this work an endeavor has been made, probably not altogether without success, of relating the history of the iron trade from the human standpoint, investing, what might otherwise be a mass of statistical data with the struggle of man against the obstacles of nature. Money is so plentiful nowadays that natural conditions offer no obstacles whatever. But the pioneers in the Lake Superior country were without means and their struggles were consequently severe. The price of the book is $2.00, postage 18 cents extra.

The boilers of the burned steamer Cormorant, which was raised recently, have been taken out and sent to Chicago on the steamer Hines. The hull was towed to Duluth.

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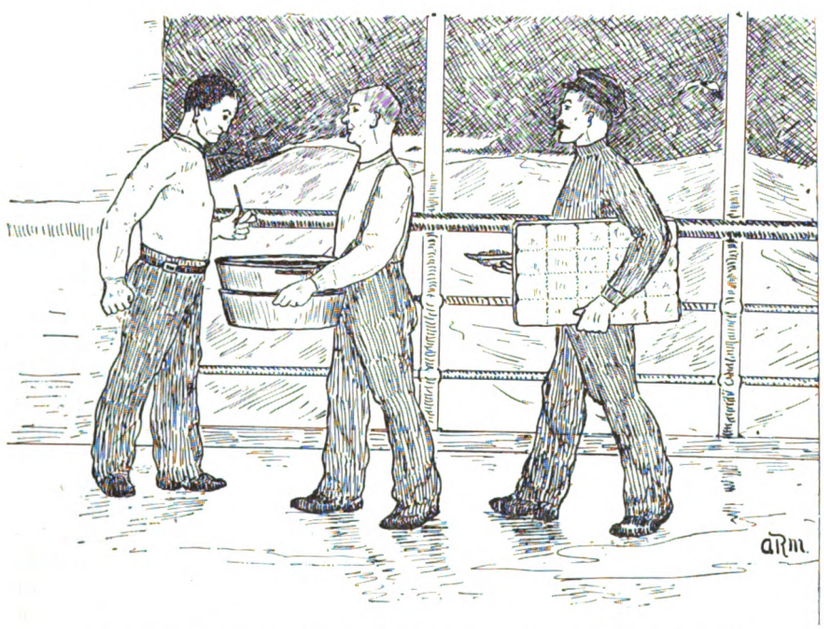
"IN THE MERCHANT SERVICE"

'Twas eventime of the first day out from port, and James B. Horrigan, with vivid recollections of an appalling sameness in the bill of fare of the previous trip, had gone on deck to meet the "cooks" coming for'ard with the supper. James B. was no invalid, and the look of anxiety on his face changed to one of profound disgust as he eyed the contents of the kids. His remarks, also, were more forcible than polite.

"Stoo again," he added, "well, ain't that the limit!"

Nevertheless he hovered around the



THE CRITICISMS ON THE FOOD WER E MORE FORCIBLE THAN POLITE.

kid bearers till they had placed the stew and other victuals on the fo'castle table, when he "rushed into the battle, and, foremost fighting—" managed to secure a liberal share of the spoils. Brute strength may be no argument, but in a fo'castle it is a mighty valuable asset, and where it is up to each man to see to his own interests in the food line, the weakling is apt to get left.

On the midnight watch, when James B. had cleaned his fire and got the job well in hand, he approached the third engineer. His face wore the expression of the chronic kicker, and the Third knew him of old.

"Say, Mr. Dunn," he whined, "ain't there no chanst of a man gettin' some meat on this packet any more? Last trip we had stoo nigh all the time, an' tonight we started in on stoo agin."

"Well," said the third, "isn't the stew any good?"

"Sure," answered the injured one, "but a feller wants a change some time in the trip."

"What about the men I saw sitting on the hatch this morning?" asked the Third. "They were making hash and seemed to have plenty of beef and vegetables on hand."

"An' don't you know where they get that meat?" said Horrigan. "Why, all them fellers give the cook a dollar a trip for the priv'lige."

"Why don't you do it?" said the Third, getting interested.

"Me," responded the indignant fireman. "Why, I'd see the cook an' his mate in hell before I'd pay for grub I'm supposed to get as part of my pay!"

"You're not the man I thought you were, Horrigan," said the engineer reproachfully as he signed to James B. to proceed with his work. "To think that you can't find some way of getting even on the food question."

The following night the engineer came on the fireman as the latter was inspecting the progress of a mess of "hoodle" cooking in an ash pan. The savory odor drifted across the boiler room, and the face of the fireman beamed in anticipation.

"So you changed your mind about that dollar deal, Horrigan," said the engineer, reproachfully. "I'm surprised at you. Don't you know that so long as you fellows are willing to pay these cooks for better food any old thing will do for those that don't?"

But Horrigan answered not at all, and for the remainder of the voyage waxed fat on the titbits from the saloon tables.

In due time the ship arrived in the home port, and the members of the crew gathered in the office to sign off and receive their hard-earned salaries. Horrigan was near the head of the line and was one of the first to get paid off. As he stepped away from the window and hoisted his bag on his shoulder he carefully ignored an individual—the cook—who was passing certain mystic signs in his direction from a corner of the pay-office.

"Hey," whispered the cook stepping to his side, "don't forget me before you go."

"Forget you," answered the cheerful James. "Lord, I couldn't forget that face o' yourn if I tried."

"Quit yer kiddin'," urged the chef, his voice hoarse with emotion, "an' let's have that dollar."

"Let ye have a dollar," yelled the fireman, attracting the attention of the whole community, "you don't want much, do you?"

"Didn't you promise me a dollar for the grub I gave you?" asked the cook in a last appeal.

James B. turned to face his amused shipmates.

"Well, ain't this the limit?" he asked. "Here's a man who wants us to pay him for the grub we eats, an' our grub is part o' our pay. I like yer nerve," he added, as he swung his kit on his shoulder and swaggered out on the street.

"He's only kiddin'," said the perturbed chef with a sickly smile to the men around, "he'll be back next trip."

"*You* won't," jeered another fireman as the line filed out of the pay office. "We've got you fired."

Honesty is at times the best policy.

Breakfast was late at Mrs. Sullavan's, and the boarders had sat at the tables some little time before the table maid had informed them of the cause of the delay.

"It's the stove, gen'lemen," she said. "We've got a new cook—Hannah havin' left us last night—an' she can't get the fire to burn nohow."

"Can't get the fire to burn," repeated one of the hungry ones, who, by the way, was attached to the engine department of a mail steamer then in port, "I guess you must have got in a load of bad coal."

"No, it ain't that, Mr. Smith," answered the dining room goddess, "the coal we're tryin' to burn is the coal we've been burnin' right along. We

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think there is somethin' the matter with the stove."

"I'll come and have a look over it," volunteered another of the boarders, a shipmate of Smith's, and there was a general adjournment downstairs.

In the kitchen they found the cook hovering over the stove trying to coax some life into the smoldering fire. She looked relieved when the maid in an undertone advised her of the professional abilities of her escort, and with hope in her heart listened to the advice of the experts.

"Let's see now," commenced Smith, "we'll first get the bars cleared to allow of a good draft passing through."

He gripped the handle attached to the bars and rattled vigorously for several minutes. Then he threw the ashpan door open. There were no ashes in sight, and the boarders waited.

"You'll find the trouble in your dampers, Smith," counseled his shipmate, as he began to test the numerous attachments on the stove. The dampers were slammed several times and the stove pipe hammered. Still no hopeful gleam from the fireplace.

"Slice her up a bit," ordered Smith, and his assistant "sliced" after the most approved methods. The spectators had taken their departure, due, no doubt, to the accumulation of smoke and dust, but the undaunted experts labored on.

Various brands of natural and unnatural draft were brought to bear on the fire, and the cook listened with awe to the profound technical discussions. She had a most annoying way, too, of reminding the volunteers that the fire was not responding to their efforts.

As the trio were about to give up the attempt in despair a welcome interruption came in the shape of the lost Hannah. As her eyes fell on the group and the condition of the kitchen they opened wide in astonishment.

"Well, fer Hivin's sake," she gasped, "what is the matter?"

"It's this darned stove of yours," said Smith, "we can't get the blamed thing to burn."

"An' no wonder," said the triumphant Hannah, "with the sun shinin' right on the fire, too."

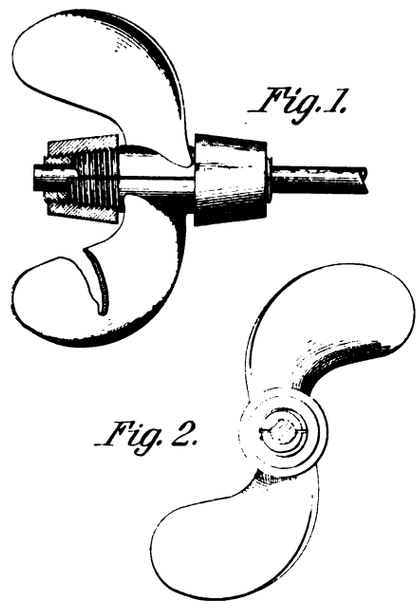
She pulled the shade of the window down, leaving the room in semi-darkness. Sure enough, the fire gradually burned up in a cheerful glow.

"That beats anything I ever saw," said Smith.

"Well," said his mate, "there is no chance of any sunshine in our fire-rooms, is there?" THE "STAND-BY" MAN.

SECTIONAL PROPELLER-WHEEL.

The accompanying figures illustrate a new type of propeller for motor boats, the object of the inventor be-



ing to provide a propeller made in sections which may be separately replaced in event of breakage, having blades so shaped that the maximum propelling force is produced with the minimum power, and avoid propeller slip. Another object is to provide a propeller so constructed that it will not drag the stern of the boat downward, but will insure the boat remaining on an even keel when under way.

Fig. 1 is a view of the propeller partly in side elevation and partly in section. Fig. 2 is an end elevation. On the propeller shaft the hub, made up of similarly disposed sections, is arranged. The ends of these sections when brought together form frusto-conical extensions which are externally screw-threaded as shown, and adapted to receive a frusto-conical nut.

Extending from each section of the hub is a blade of peculiar contour, the inner or base portion of the blade being disposed diagonally upon the hub section, and the blade itself inclined backward over the adjoining end of the shaft. The blade is curved transversely, so that the convex or advancing edge will cut into the water and cause the concave face of the blade to constantly press against the water.

After the blades have been assembled by clamping the hub sections upon the shaft, and same revolved, it is claimed that the water is propelled longitudinally of the device, with no radial motion or slipping of the blades such as occur where flat diagonally disposed blades are used, and the curved blades continually exert a pressure on the water due to the constantly changing contour thereof. It is claimed, also, that a propeller of this type will not pull downward on the stern of the boat, and that the boat will be made to more quickly respond to the rudder.

The inventor of this sectional propeller is Robert William Shaw, of Stamford, Conn.

BROWNHOIST CRANES.

The Brown Hoisting Machinery Co., Cleveland, O., has lately issued an attractive circular descriptive of the Brownhoist locomotive grab bucket cranes for handling ore, coal, limestone, slag and sand. The illustrations show the cranes handling ore from stock piles, gondola cars, etc., and the possibilities attending the use of the equipment are at once apparent. There is nothing experimental about the equipment, as hundreds of the machines are in successful operation. The cranes are operated on any standard gage railroad track and many are used on trestles. Under ordinary conditions one crane is capable of making from 50 to 75 trips per hour. The crane is ordinarily supplied with a Brown patent grab bucket having a rated capacity of 24 cu. ft. in ore. As this bucket is extremely efficient, frequently picking up from 2 to 2½ tons of ore, it will be seen that one crane can take care of considerable tonnage. The cost of operation is low as only one man is required to operate the crane. The catalog contains a partial list of iron and steel companies that are using the Brownhoist locomotive cranes. It is noted that the Carnegie Steel Co. has 50 of them in its various works, and that other companies have anywhere from one to 20. The illustrations are especially fine and show the crane in all stages of operation.

NICHOLSON LOGS.

Barrett & Lawrence, 662 Bullitt building, Philadelphia, eastern agents of the Nicholson Ship Log Co., of Cleveland, have received a contract from the Standard Oil Co., of New York, to install a No. 1 Log on the tank steamer City of Everett. C. P. Nicholson of San Francisco, western agent, has contracts from the Pacific Coast Steamship Co., to install No. 1 logs on the steamers Senator and Queen.

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FREIGHT SITUATION.

The season of navigation is practically over though a few vessels will operate in the coal trade until next Sunday under excessive insurance. Ore shippers were through some time ago, being so well supplied that the rate closed as it had begun, at 75 cents. Coal rates have, of course, during the week been marked up, but the excessive insurance absorbs a great part of the profit, the extra insurance alone amounting to about $1,700 for a trip. On some of these belated coal shipments $1 is being paid Several of the larger companies, notably the Pittsburg Steamship Co. and the Cleveland Cliffs Co. are through, and their boats will be laid up by the end of the present week.

Complete ore figures are not yet available, but with one port missing, 3,080,570 tons were sent forward during November, which is an increase of 470,716 tons over the corresponding period last year. The missing port will probably add over 1,000,000 tons to these figures, making the total shipments for the year safely 41,500,000 tons.

PIG IRON SITUATION.

An increase of interest in iron and steel lines as a whole is noted and a better feeling predominates. Curtailment of production, however, has by no means ended. It is estimated that 65 per cent of the steel mill capacity of the Carnegie Steel Co. is now idle. More inquiry for pig iron is being made, although the market continues to sag. An improvement is noticeable in tin plate. The monthly blast furnace statistics of THE IRON TRADE REVIEW show the production for November to be 1,815,224 tons, against 2,359,690 tons in October. The number of furnaces in blast Dec. 1 was 227, against 314 in blast Nov. 1.

DODD-ROGERS NAUTICAL SCHOOL.

The Dodd-Rogers Co., 1926-1936 East Sixth street, Cleveland, O., will open a school of navigation upon the close of the lake season. The school will be known as the Great Lakes Nautical Institute and will be under the supervision of A. D'A. McNevin. During the past three or four years great interest has been awakened in the subject of lake navigation and the Dodd-Rogers Co. have established a department of nautical instruments, carrying everything necessary to the safe navigation of a ship. E. H. McNevin will be established by the company at the Sault for adjustment of compasses and will be on call between Port Huron and Duluth. The Great Lakes Nautical Institute will be completely equipped for thorough instruction in lake navigation and it is hoped to interest not only masters and mates, but the younger element in the course as well.

CAPT. UBERROTH'S GOOD SERVICE.

Capt. Uberroth, commanding the revenue cutter Tuscarora, has earned the approbation of vessel owners generally in cruising along the shores of Lake Superior this fall for the purpose of seeking and aiding vessels in distress. This is a new departure for the Tuscarora but one with which marine men are heartily in accord. The advantage of having a relief ship at hand is readily appreciated. The entire south shore of Lake Superior from the Sault to Duluth has been chosen by Capt. Uberroth as his cruising ground, as it is along this stretch of water that the majority of fall accidents occur. Capt. Uberroth will continue his cruise until the close of navigation.

AROUND THE GREAT LAKES.

The steamer Monohansett, which burned on Lake Huron recently, is a total loss.

The Weitzel lock of the Sault canal was closed to navigation for the season last Thursday.

The Stannard Rock and Huron Island lights, Lake Superior, have been extinguished for the season.

The steamer Iron King and barge Iron Queen are being stripped at Milwaukee where they will be tied up for the winter.

Capt. John Duddleson, of the steamer Waldo, has recovered from his recent illness and is again in command of the steamer.

The grain elevators at Duluth were very busy on Friday of last week, loading 1,302,000 bu. of wheat into four steamers going to lower lake ports.

A dispatch from Buffalo is to the effect that during 48 hours, Dec. 1 and 2, 1,295,000 bu. of flax and 1,256,248 bu. of wheat were received, while coal shipments during the same period amounted to 49,100 tons.

The steamer Scranton, of the Mitchell fleet, struck against the pier head at Ashtabula last Sunday while being towed out of the harbor, stern first, and broke her wheel and quadrant. She had to be taken back for repairs.

The hull of the steamer Lizzie Madden, which burned on Saginaw Bay recently, is ashore at Little Charity Island. The hull is a total loss, but it is hoped that the engine and boiler can be saved.

Commodore R. D. Bucknam, formerly master of a whaleback on the great lakes, now naval adviser to the Sultan of Turkey, has been promoted to the rank of rear admiral with the title of pasha.

President Livingstone, of the Lake Carriers' Association, has announced that the annual meeting of the lake carriers will be held at the Hotel Ponchartrain Jan. 9. The executive committee of the association will meet on Jan. 8.

The steamer Socapo, upbound with 10,000 tons of coal, stranded on the breakwater shoal at Buffalo last Saturday, owing to thick fog. She was released the following day after lightering 500 tons of her cargo, which was later reloaded.

The bulletins of the Submarine Signal Co. show that the steamer J. H. Sheadle has picked up the Point Au Pelee sound signal at a distance of six miles. The steamer Thomas F. Cole picked up the Detour station at a distance of three miles.

The new tug A. C. Harding of the Great Lakes Towing Co.'s fleet will be stationed at Port Huron during the winter. The tug George Nau of the same fleet has been chartered by the Pere Marquette Steamship Co. and will be operated at Ludington.

The steamer City of Glasgow of the Hutchinson fleet, laden with coal, ran on Peshtigo Reef last Thursday during a snow flurry, the light at this point having been removed two weeks ago. The steamer was released on Saturday, and is not thought to be damaged.

The steamer Wm. M. Mills of the Weston Transit Co.'s fleet carried a record cargo of wheat last week from Duluth to Buffalo. Her cargo consisted of 416,000 bushels of wheat. This beats the record of the steamer W. B. Kerr made on May 4 last when she brought down 402,000 bushels.

The east channel at the Lime Kiln Crossing, Detroit river, used by upbound boats, will be closed Dec. 5, in order that contractors may complete the work of cutting away the rocky ridge left between the east and west channels. After this date all vessels will use the west channel until the close of the season.

The Schnorbach Co. of Muskegon, Mich., was awarded the contract for building the government breakwater at Ludington on their bid of $631,000. The work will consist of an extension of 1,800 ft. on the north side and 2,000 ft. on the south side. This will give Ludington harbor a thoroughly modern breakwater, the construction of which will take six years.

Capt. James Reid, of the Reid

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Wrecking Co., who is working on the wrecked steamer Spokane on Gull Rock, Lake Superior, expects to take the steamer to dry dock before the close of navigation. The weather is extremely rough and bad for wrecking operations, and the steamer is cracked in the center and a portion of the deck is telescoped, but nevertheless Captain Reid is confident that he can release her very shortly.

The Pittsburg Steamship Co. on Tuesday of this week brought suit against the Wilson Transit Co.'s steamer Henry Oliver for damages inflicted by the steamer upon the barge Manila of the Pittsburg Co.'s fleet It is alleged that on the night of Aug. 20 last, when the John Ericsson was towing the barge Manila through Grosse Point cut, Lake Michigan, the Oliver in attempting to pass her got too close and the suction drew the Ericsson over. The Oliver, it is stated, was then reversed, drifting across the channel in such a way that the Manila ran into her. A lien is sought for the cost of damage, $8,000, and the loss of time, valued at $11,000.

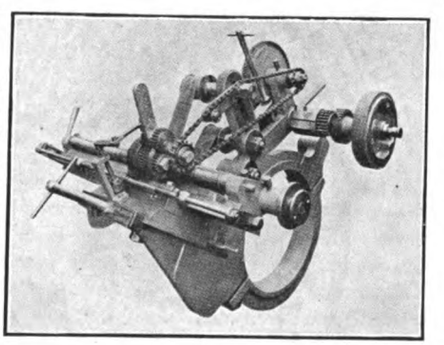
The wooden steamer City of Glasgow, owned by Hutchinson & Co. of Cleveland, caught fire when three miles off Green Bay harbor last Tuesday night, and is thought to be a total loss. The crew of eighteen men were rescued from the burning boat by the tug Taylor. The fire started in the vicinity of the engine room and spread so rapidly that the men were driven from the engine room so that the fire pumps could not be used. The steamer was without cargo on her way to Escanaba to load ore and was in command of Capt. John A. Logan. The vessel was built by James Davidson in 1891 and was rebuilt in 1901. She measured 297 ft. keel and 41 ft. beam and carried 3,000 gross tons.

The steel barges Amazon and Polynesia belonging to the fleet of Capt. James Corrigan, of Cleveland, will be converted into steamers during the present winter at the Cleveland yard of the American Ship Building Co. Work will begin at once, and the engines of the wooden steamers Caledonia and Italia of the same fleet will be taken out and placed in the Amazon and Polynesia. It is not known at present what will be done with the Italia and Caledonia. The Polynesia and Amazon are duplicates and measure 376 ft. keel and 46 ft. beam, having a carrying capacity of about 6,100 gross tons. They were built in 1897. The change will lessen the capacity of the boats about 200 tons each. The Australia, of the Corrigan fleet, which was also converted into a steamer several years ago, will undergo some changes during the winter. Her between deck beams will be set back in order to make more room for the clamshells.

When the steamer Charles M. Warner of the United States Transportation Co.'s fleet reached Buffalo on Monday last, her captain related a very interesting circumstance concerning the steamer's trip. About two weeks previous, when the Warner left Buffalo with a cargo of coal for Escanaba, she crashed into the red buoy which had been set up to mark the breakwater shoal. The following morning the buoy was picked up about two miles down the river, but the chain and anchor were missing, and everyone thought they had gone to the bottom of the lake. After unloading her cargo at Escanaba the Warner went to Duluth for grain, and while going past the Sault the captain suspected something wrong with the steering gear. A diver was sent to examine the shoe, and after some delay the chain and anchor were released and taken on board the steamer. The Warner had traveled 1,000 miles in and out of harbors in this condition without meeting with injury, while the chain was worn thin by contact, with the boat's rudder. To have made this journey without a single mishap is considered a wonderful performance.

COMMUTATOR GRINDER.

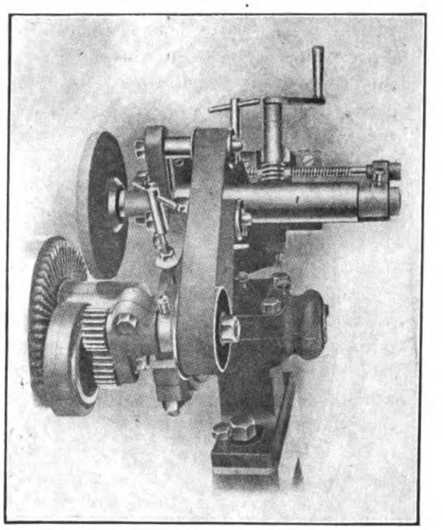
The development of flats on commutators is a constant source of trouble to the engineer and electrician, necessitating, as it does, the occasional turning or grinding down of the commutator until the flat is removed. The inevitable mechanical weakness of a commutator, being built up, as it



COMMUTATOR GRINDER WITH AUTOMATIC FEED.

were, in parts, calls for delicate handling in the truing up, and the use of reliable machinery in the process.

The accompanying photographs show a type of commutator grinder being placed on the market by the Phillips Commutator Grinder Co., of London, England, with offices at 320 Broadway, New York. In the Phillips machine the grinding spindle is driven direct by means of a specially prepared rubber friction wheel running on the commutator, so that no motor is required to drive it. This



GRINDER SPECIALLY DESIGNED FOR USE ON SHIPBOARD.

spindle is carried by a strong slide, and, when working, moves to and fro across the face of the commutator. It is automatically reversed at each end, and is so constructed that stops can be set as in a planing machine, grinding the surface right up to the connecting wires and back to the edge. Fig. 1 is a general view of the automatic machine, showing the clamp arrangement suitable for fixing around the rocker bearing. Where no rockers are used, the machine can be secured to the outer bearing, or secured by suitable means to the bearing cover bolts.

Hand-feed machines are designed for commutators up to about 9 in. with a 6-in. face, but for commutators of larger size the automatic machines are recommended. The hand-feed machine shown is very compact, and is designed specially for dynamos on board ships, which, as a rule, are erected close to the bulkheads, or other limited accommodation, allowing but little room for working. This machine can be adapted for use, also, on dynamos in other locations.

The tug Cora L. Staples arrived at New London on Sunday morning and reported that Chief Engineer Matthew McCreery had been drowned between Point Judith and Watch Hill. The captain believes the engineer was thrown into the sea by a lurch of the tug, as the weather was rough.

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LONG'S COURSE AND BEARING CORRECTOR

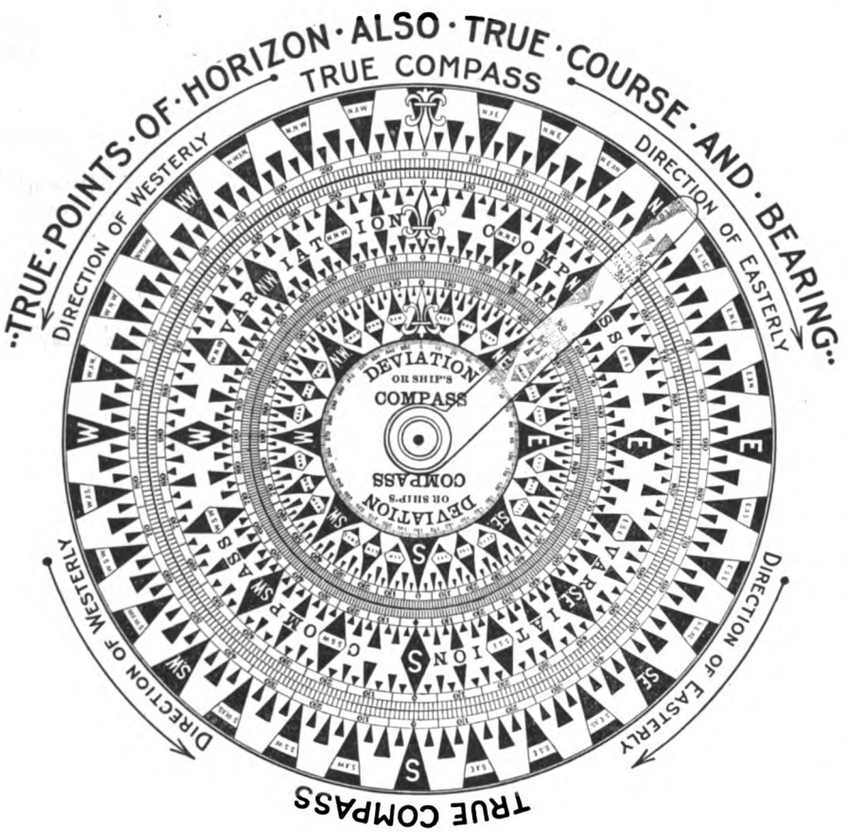

FIG. 1.

The Corrector is an instrument that should be in the hands of every man in the for'ard end. The device solves all problems of the compass mechanically; corrects the course of itself for variation and deviation, both from true to compass and from compass to true in the one operation. It indicates the amount and direction of the deviation. Naming the deviation is one of the most perplexing things for the beginner to get wise to. Use of the Corrector will make this all very plain. There are no end of things that can be performed on this device, and it recommends itself particularly for the simple manner in which all problems can be worked on it. The operator can see every move he makes or is required to make. He cannot make a mistake because the device pictures the example.

GENERAL RULE FOR THE USE OF CORRECTOR.

Set the N-point of the red card (card marked "Variation Compass" on Corrector—second circle) with reference to the N-point of the black one (outside circle marked "True Compass" on Corrector), in the direction and by the amount of the variation; similarly, set the N-point of the green card (marked "Deviation or Ship's Compass" on Corrector—inside card), with reference to the N-point of the red one, in the direction and by the amount of the deviation; then any one of the three courses—the true, correct magnetic, or compass course—being given, revolve radial arm till its central edge is upon that course, when the other two are seen on the same edge.

To illustrate: Supposing a ship was steering NW x N ¼ N by compass; Var. 4° Wly, Dev. 10° Wly; required the true and correct magnetic courses; set the N-point of red card at 4° west of N-point of black card (true circle), and holding it there, set the green circle with its N-point 10° west from the N-point of red circle, and holding the two circles with the left hand revolve the radial arm with the right hand till its central edge is directly over NW x N ¼ N; then the corresponding divisions in line on the same edge will be found to be: on the red card, NW ⅜ N, being the correct magnetic course; and NW on the card in black card, being the true course. Fig. 2 is a picture of the foregoing example.

The cards are in colors to make them the more distinguishable, especially in reading the coinciding points. The radial arm is transparent celluloid so that all divisions can readily be seen through it. The foregoing pictures do not do the Corrector justice, for in reducing them from the original, shadows show as circumfer-

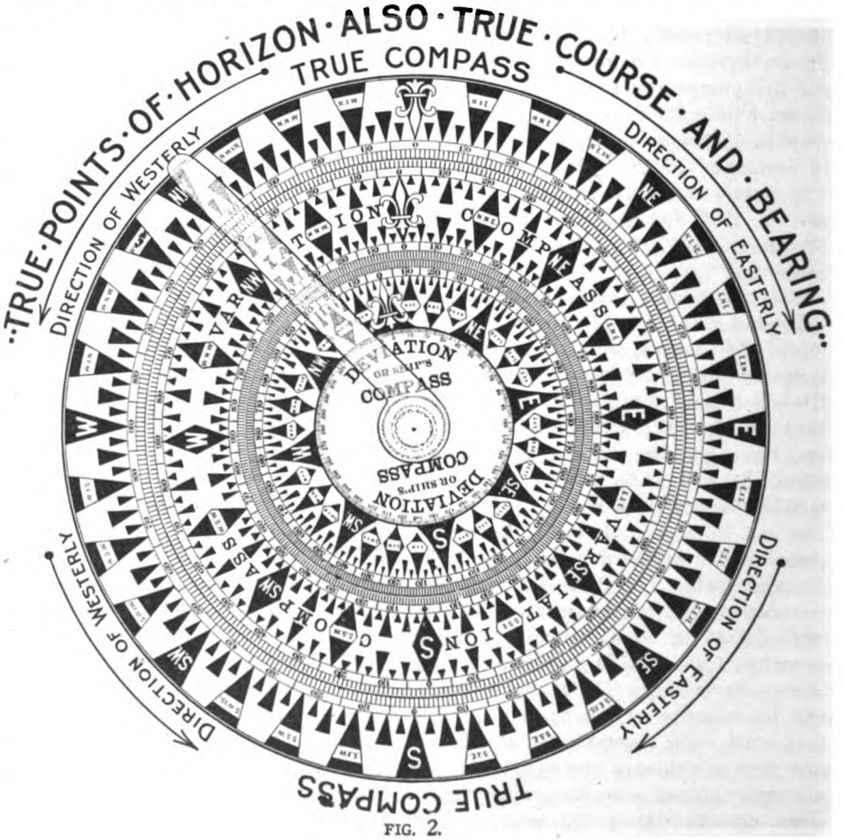

FIG. 2.

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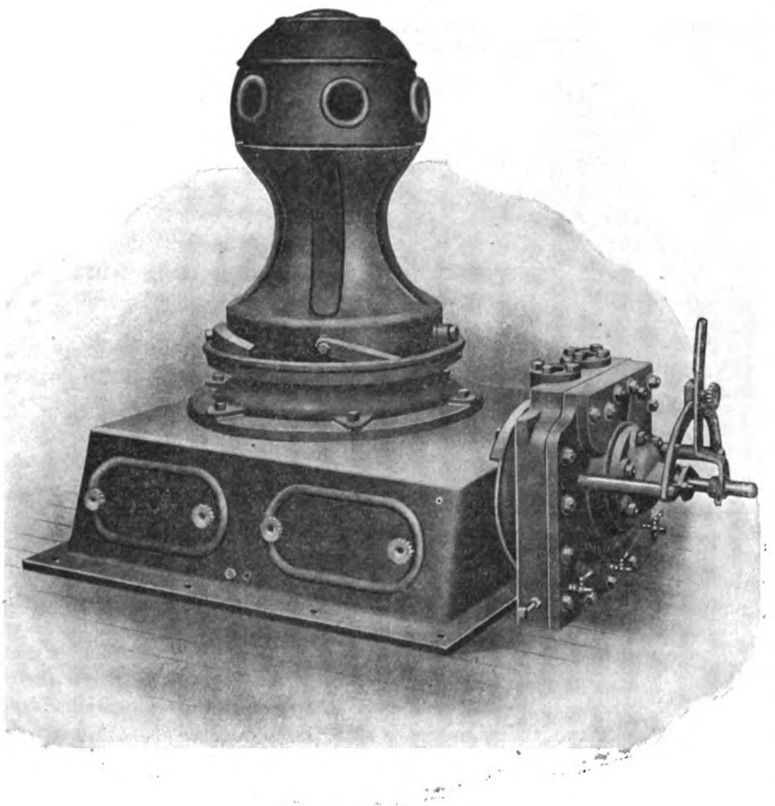
ence lines where none occur. The device is as near perfection as possible.

The Corrector is now ready for marketing. The price is $1.50, postage prepaid. Address, MARINE REVIEW, Cleveland, O.

NEW DAKE STEAM CAPSTAN.

The Dake Engine Co., of Grand Haven, Mich., have lately brought out a new steam capstan which is extremely simple in construction and is



NEW DAKE STEAM CAPSTAN.

unequaled for ease in handling and power, as well as compactness. It has no dead center, and is made for two pulling speeds regulated by the throw of the reversing lever. The working parts being entirely enclosed overcomes all danger from dust or dirt. It can be simply placed on the deck and bolted down, steam and exhaust pipes connected, and it is ready to work. The company makes only one size. Size of engine, 10 H. P. Distance from deck to center of capstan head, 28 in. Size of steam pipe, 1¼ in. Size of exhaust pipes, 1½ in. Over all dimensions of bed, 42½ x 45 in. This capstan is spoken of very highly by those who are using it and the price is very reasonable.

WORK AT FORE RIVER.

The steam collier Malden, built by the Fore River Ship Building Co., for the Massachusetts Steamship Co., was given her official speed trials on Friday, Nov. 29, 1907, and attained a speed slightly in excess of 12 knots, averaging 11.7 knots for four hours. The Malden is the second of a fleet of three vessels and will be delivered during the coming week to the owners. The Everett is already in service and on a recent trip to Baltimore averaged 11.3 knots, including 10 hours slow down on account of fog and thick weather. The third boat, the Melrose, will be delivered about Jan. 1.

The steamer Creole has just been docked at the large dock at the navy yard, Boston, where the bottom was cleaned and painted and a new set of screw propellers fitted. She will be standardized on the Provincetown mile course on Monday, Dec. 2, 1907. If this trial is successful, the vessel will be loaded to 24 ft. 10 in. main draught and given a 24-hour trial on which she must average 16 knots.

The keel of the battleship North Dakota will be laid on Dec. 16. This vessel being longer than any vessel previously built by the Fore River Ship Building Co., made it necessary to increase the foundations for the building ways. These have been constructed of concrete and are nearly completed, a very large amount of steel material has been received and a very considerable amount of shop work performed so that when the actual work of construction commences, it will be pushed forward very rapidly.

Transfer Tug No. 21 for the New England Steamship Co. will be launched on Dec. 5, 1907.

Preliminary work has been begun on four submarine boats of the Octopus type 105 ft. long and three of an improved type 135 ft. long.

It is expected that the preliminary speed trials of the scout cruiser Birmingham, fitted with reciprocating engines, will be held during the early part of February.

AN INTERESTING EXHIBIT.

The American & British Manufacturing Co., Bridgeport, Conn., will have an interesting exhibit at the National Motor Boat and Engine Show, Grand Central Palace, New York, from Dec. 7 to 14. The company will exhibit the famous racing boat Den. This 30-ft. boat holds the American record for one mile, time 2:07, made at the Hudson river races in September last, besides which on preceding days she won the 30-mile and 150-mile races on record time. The Den, C. H. Herreshoff design, motor, is rated 72-80 H. P., and is a marvel of power, simplicity of design and compactness, the starting device, a multiple disc clutch with reverse mechanism, being integral on the crank case. This same sized motor in the 70-ft. cabin cruising yacht Alabama also holds the record in her class.

The company will exhibit both these engines and also the new 40-H. P. marine motor of the same model. An exhibition will be made of one of these 40-H. P. motors running with cylinders sliced, showing the pistons and valves in action.

The New Britain Machine Co., New Britain, Conn., has issued a little folder descriptive of the New Britain band saw filer. Ever since the band saw machine was introduced the sharpening of the saw has been a vexing problem. This little catalog gives a complete description of the filer, showing how sharpening may be accomplished by any novice in a manner that has never been surpassed and at a trifle of the cost of ordinary sharpening machines.

The life saving stations at North Manitou Island, South Manitou Island and Sleeping Bear Point, Lake Michigan, were closed last Saturday for the season.

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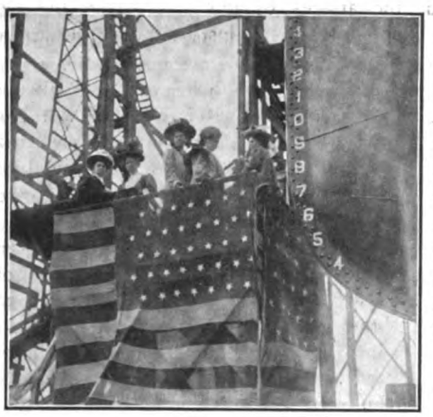


ON THE LAUNCHING STAND.

LAUNCHING THE ALTAMAHA.

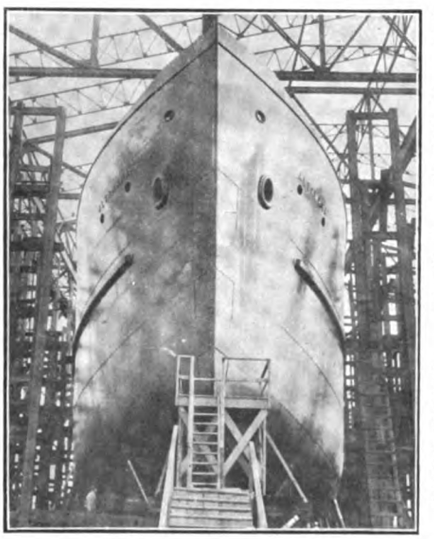
The Fore River Ship Building Co., Quincy, Mass., launched the steamship Altamaha for the Brunswick Steamship Co. on Tuesday, Nov. 26, the sponsor being Miss Caroline Pearl Godfrey, daughter of Wm. H. Godfrey, foreman shipwright of the Fore River Ship Building Co. The Altamaha is especially designed to carry the maximum of freight on an unusually light draught and consequently is arranged with the propelling machinery at the after end of the vessel, the remainder of the ship being devoted to the stowage of cargo. To minimize broken stowage the pillaring of the cargo holds is carried out on the girder system with two large columns in each hold connected at the head to a continuous deck girder. Special consideration has been given to the strength of the vessel which is in excess of that usually provided in ordinary freighter constructions.

She is constructed of mild steel and is of these dimensions: Length over all, 313 ft.; breadth molded, 40 ft.; depth of hold, 25 ft.; displacement in tons, 5,000 tons.

There are three large cargo holds having four hatchways suitably arranged for the expeditious handling of freight. In addition to these hatchways the cargo can be manipulated through four cargo ports on each side of the vessel which are about 10 ft. by 7 ft. in the clear and arranged with sliding trolley doors. These cargo holds are isolated from each other by steel watertight bulkheads, which with the collision, machinery space and stern tube bulkheads divide the vessel into seven separate watertight compartments which will insure the vessel floating with any two of the compartments flooded by the sea and in addition to this will insure greater isolation in the event of fire, to one compartment.

The vessel has been rigged with two steel pole masts having four derricks fitted to each, with a working capacity of 7½ tons per derrick. These derricks are stepped on strong steel tables and are suitably rigged for working the cargo by means of powerful winches, in the most expeditious manner possible. These winches are of the most up-to-date type and are arranged in pairs at the forward and after sides of the masts, making eight winches in all.

To insure that the vessel will trim properly when steaming light, owing to having the machinery arranged at the extreme after end, deep trimming tanks have been arranged right forward and in the fore hold a water ballast tank has been placed.



ON THE STOCKS.

The officers' quarters are located in a steel superstructure built around the engine and boiler casings, providing especially well lighted and ventilated staterooms for the officers and engineers, with a handsome dining saloon amidships at the forward end of the superstructure. The crew, firemen, oilers and water tenders will be berthed on main deck in way of machinery space. The superstructure is decked over forming a bridge deck on which the life boats are stowed, and with pilot house and captain's room at the forward end. The captain's suite comprises bed room and sitting room with stairs leading therefrom to the dining saloon on upper deck.

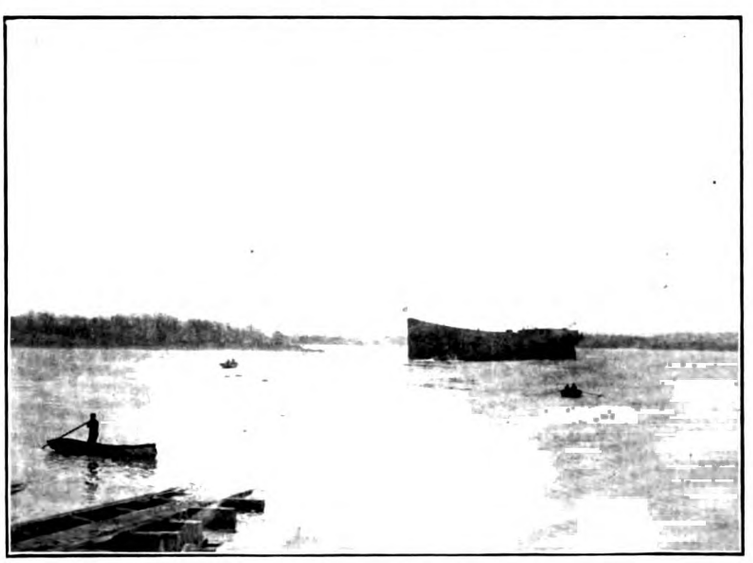
The usual pumping and drainage, sanitary and firemain system have been arranged for on the most approved lines and in addition an electric light installation of ample power will be fitted.

Steam steering and screw hand gear are installed with steering stations in pilot house and on quarter deck aft. On this deck will also be fitted a powerful steam warping capstan.

The anchor handling arrangement consists of a steam windlass of the most approved make with the operating engines placed on main deck forward under cover.

The propelling machinery consists of one set of triple-expansion surface condensing engines supplied with steam by two single-ended Scotch boilers suitable for developing sufficient power to propel the vessel at a continuous speed of 10½ knots per hour.

Frank Waterhouse & Co., Seattle, Wash., have chartered five British steamers to operate a line between Pacific coast ports and Australia and New Zealand. A 28-day service will be maintained from San Francisco, replacing the ships of the Oceanic Steamship Co., which abandoned their Australian service some time ago owing to non-support.



ALTAMAHA IN THE WATER.

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TRADE NOTES.

The Buckeye Engine Co., Salem, O., has just issued "A Picture Talk on Halos" by Prof. A. C. Tinic, being a very clever description of the Buckeye electric blue printing machine.

The Skaneateles Boat & Canoe Co., Skaneateles, N. Y., has just issued a catalog descriptive of their high grade launches, pleasure boats and canoes. The catalog is well illustrated with half-tone pictures of the products of the company. In each case a complete description is given of the craft, together with price.

The Allis-Chalmers Co., Milwaukee, Wis., has just issued a catalog descriptive of Allis-Chalmers direct-current motors and generators. The booklet gives a complete description of the installation of these machines as well as a description with sectional views.

The New Britain Machine Co., New Britain, Conn., has recently isssued a catalog descriptive of New Britain shop furniture, consisting of tool racks, lathe pans, lathe racks, shelving, stools, trucks and numerous other labor-saving contrivances. Each bit of furniture is illustrated and well described.

The Nelson Valve Co., Philadelphia, Pa., manufacturers of improved gate and globe valves for steam, water, gas, air and ammonia, have just issued a catalog descriptive of their various products. The catalog, in each case, contains sizes, price lists and likewise a complete index so that every part is immediately accessible.

Marine Iron Works, Station A, Chicago, Ill., has just issued a supplement to Catalog No. 17. This catalog contains excellent illustrations and descriptive matter of centrifugal circulating pumps, steam winches, deck hoists, fore and aft compound engines, horizontal firebox marine boilers and marine electric lighting sets manufactured by the company.

A recent application of Voltax compound, a non-corrosive paint manufactured by the Electric Cable Co., 17 Battery place, New York City, was the painting with it of the steel hull of the municipal ferry boat Richmond, of the city of New York. The use of Voltax for similar work is rapidly increasing, due to the successful results secured through its use.

The New Britain Machine Co., New Britain, Conn., has recently put out a little folder giving a few pointers on their setter. The Equal Blow band saw setting machine which this company is making gives a graduated hammer blow on the right and left hand tooth at the same instant. This saves more than half the time over slower mechanisms and prevents buckling and twisting of saws.

The Emmert Mfg. Co., Waynesboro, Pa., manufacturer of the Emmert patent universal vises, has issued a little booklet concerning them. In the movement and service of these vises they are almost like the human hand. The gripping of the digits, the rolling of the hand and forearm, the drawing extension of the elbow and the swinging of the arm in circuits are all quite fully provided for in the movements and positions secured by these vises. The little catalog contains a complete description of all the vises with price list.

The G. H. Williams Co. of Cleveland has recently supplied its traveling derrick to four sand and gravel companies. They are the C. H. Little Co. Detroit, Mich.; the Erie Sand & Gravel Co., Erie, Pa.; the Rogers Sand Co., Duquesne, Pa.; and McCrady Bros., Braddock, Pa. The company is also experiencing a lively demand for its Faivrette buckets for handling sand and gravel, having recently secured orders from Vancouver. M. A. Hanna & Co., who have four of the 1-ton single ore buckets in use, have purchased three more. The C. & P. docks at Cleveland will be equipped with six of them and one at Erie.

The Watson-Stillman Co., New York, has recently issued sectional catalog No. 72, descriptive of turbine pumps. As in the case of former catalogs, this is an assortment of sheets selected from over 800 pages, especially relating to turbine pumps. Complete description is given of the twinvolute turbine pump of which invention the Watson-Stillman Co. are the sole manufacturers. This catalog is quite complete in its special subject and it would be well for every manufacturer to keep it in file. Invaluable tables of data are given in relation to capacity in gallons per minute at velocities in feet per second, and also pressure per square inch in pounds.

The Teredo Proof Paint Co., Whitehall building, 17 Battery place, New York, has recently issued a catalog descriptive of Teredo Proof paint which is represented as being an absolute protection against the teredo and a peerless wood preservative. The claims of the company would appear to be borne out by the number of excellent testimonials from government engineers and other impartial authorities. Quite a number of dredging concerns have given testimonials as to the efficacy of this preservative. The company claims it to be an absolute protection for submerged wood against the attacks of the teredo and for exposed wood against decay from atmospheric conditions.

The Allis-Chalmers Co., Milwaukee, Wis., has just issued Bulletin No. 1.037, entitled "Testing Alternating Current Generators." This method of testing the generators was perfected by B. A. Behrend, chief electrical engineer of the company. It has taken many years to evolve this manner of testing which enables the company to obtain with comparative ease the most important data of the performance of alternating current generators while they are yet in the shop, the machines being subjected to full load conditions without actually putting them under full load. The bulletin will be sent to any electrical engineer upon request.

The December issue of *Graphite* issued by the Joseph Dixon Crucible Co., Jersey City, N. J., contains 10 pages devoted to the Atlantic City Convention of the American Interurban Railway Association. At this convention the Dixon company had a most unusual display. In addition to their regular booth on the steel pier the company constructed on the beach figures in sand representing the various uses of graphite products. The figures included an automobile, a horse car, lead pencil, lamp posts and factory buildings. The display attracted much attention. *Graphite* is full of useful information concerning the uses of graphite as a lubricant and protector. The December issue of *Graphite* is in a pictorial sense a mighty interesting issue and will be sent to anyone upon request.

The Allis-Chalmers Co., Milwaukee, has published a bulletin, entitled "The Hancock Jig," No. 1403, which is of value to mine owners and engineers, in view of the fact that it contains information whereby ore that is ordinarily considered too refractory for concentration, can be made a more valuable asset through the process of jigging described in this bulletin. The facts regarding the production, water saving, etc., of the Hancock jig, as brought out in this publication, are based primarily upon the performance of the first machine installed for the Arizona Copper Co., and confirmed by working tests made at other plants. The Hancock jig not only decreases the cost of construction of a mill but has been a success on account of its large capacity, small floor space, simplicity and saving of labor.

The general offices of the Wheeler Condenser & Engineering Co. will be removed from New York to the works at Carteret, N. J., on Jan. 1, 1908, and all the present New York employes transferred there. The company is

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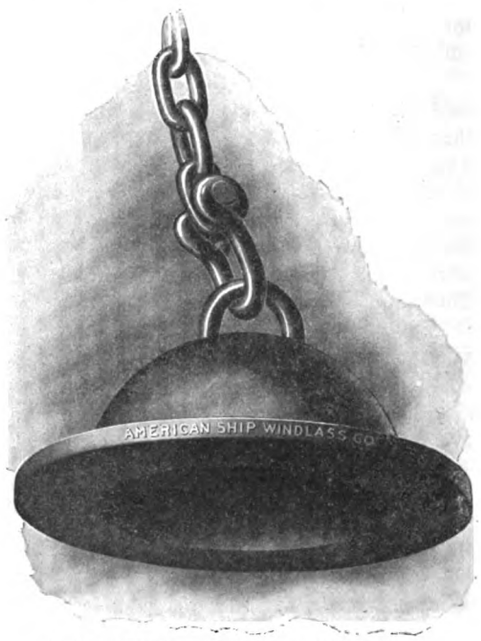
erecting a very extensive addition to their present office building in Carteret to accommodate the increased force and to provide room for the executive offices. The drawing room will be enlarged and occupy practically the entire upper floor of the office building, while additional room will also be provided for the engineering department proper. A kitchen from which luncheon will be served at noon will add to the comfort and convenience, and also give that opportunity for the heads of departments to meet daily which has been found of such value and help in similar large establishments.

The Marine Mfg. & Supply Co., 157-158 South street, New York, has just issued Catalog A descriptive of air ports, dead lights, ventilators, etc. This company has been specialists in manufacturing marine air ports for the past 50 years. Obviously the catalog cannot reproduce patterns of all of them, but the variety is complete for every form of vessel from a coal barge to a battleship. The company has also put out Catalog C descriptive of their steering apparatus, steering wheels and rudder attachments. This catalog is complete including sizes and prices. The concluding pages are devoted to a hydraulic ash ejector which, it is claimed, will eject more ash with less water than any other ash ejector made; and a canvas pick-up buoy for small yachts and can buoy for large vessels. This is a very convenient arrangement for vessels which have to come to the same mooring place frequently.

The M. T. Davidson Co., manufacturers of pumps, pumping engines, condensers, evaporators and ash ejectors, has just issued a catalog descriptive of its products. The catalog opens with a description of the Davidson steam pump which is of the single cylinder type. This pump is economical in the use of steam and will start from any point of the stroke and make its full stroke under all conditions. It will pump any fluid giving a steady and uniform delivery under light and heavy pressures, low or high speeds. A good description of the pump is given with line drawings. In addition every part of the pump is illustrated individually and cataloged by number, so that no confusion whatever can occur in ordering any part. Pumps, condensers and ejectors are all beautifully illustrated, the catalog being complete in every particular.

The Williamson Bros. Co., engineers, founders and machinists, Philadelphia, Pa., has just issued a catalog devoted to their products including steam steering engines, tiller steering gears, electric steering gears, telemotors, hoisting engines, locomotive cranes, boat cranes, evaporators, distillers and condensers. Steering engines have been a specialty with this company for the last 20 years. The best proof that they have withstood all tests is the fact that steamship builders and owners who have used them continue to order them year after year. Such cases are numerous. The catalog opens with a description of spur-geared hoisting engines. These engines are of three kinds, cone friction drum, link motion and positive clutch on crankshaft. Complete descriptions of the three kinds are given with illustrations. Excellent descriptions are given of the company's winch engines. Complete description is given of the locomotive steam crane with two superb illustrations. The part devoted to steering gear and steering engines is very complete both as to letter press, sectional drawings and photographs.

The Niles-Bement-Pond Co., 111 Broadway, New York, has issued a fine catalog descriptive of the Pond rigid turret althe. This machine is designed for providing work ordinarily done on engine lathes and is especially adapted to such work as gear blanks, fly wheels and gas engine cylinders, increasing the production from 50 to 150 per cent over ordinary engine lathe methods. It can also be used for heavy bar work, such as wrist pins, projectiles and other similar work. Two sizes, 21-inch and 28-inch, are regularly built. A separate department of works is devoted exclusively to the manufacture of this machine. Among the advantages of the Pond rigid turret lathe are: First, the wide faces of the turret enable the heaviest facing and multiple turning and forming tools to be rigidly attached; second, that rigid facing tools and short boring bars can be used, the design of the cross carriage being such that it can be run under the chuck entirely out of the way of the turret; third, the turret indexes and clamps automatically and has rapid power traverse in both directions, making the machine easy and quick to handle; fourth, separate lead screws are provided for turret and carriage; fifth, the tools in the standard tool equipment are provided with very wide adjustment so that pieces of various sizes and shapes can be successfully handled without the use of special tools.



NEW TYPE OF MOORING ANCHOR.

MOORING ANCHOR.

The American Ship Windlass Co., Providence, R. I., has recently developed a new type of mooring device which is intended to hold more than the ordinary type of mushroom anchor in a soft or muddy bottom. The anchors were developed for local trade and are locally known as saucers. As they drop overboard the air is expelled and the suction produced by the hollow hemisphere is enormous. It requires a great deal more power to lift this anchor after it is once set than the mushroom type of mooring. A great advantage in this type of mooring is that the long shank is done away with, so that if the boat is moored in shallow water there is no danger of its riding on to the shank and punching a hole in the bottom.

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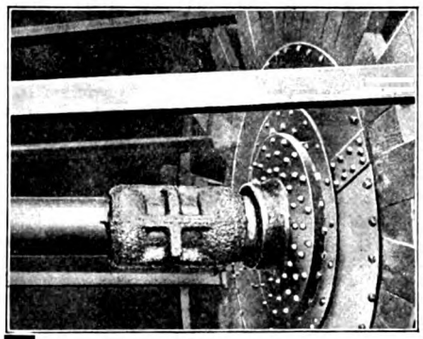
THAT'S OUR TRADE

WE supply everything that a vessel needs —and our guarantee goes with everything we sell.

Let us submit a bid for fitting out your ship this spring.

THE UPSON-WALTON CO.

CLEVELAND, O.



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Write for Pamphlet No. 18-E.

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INSURANCE

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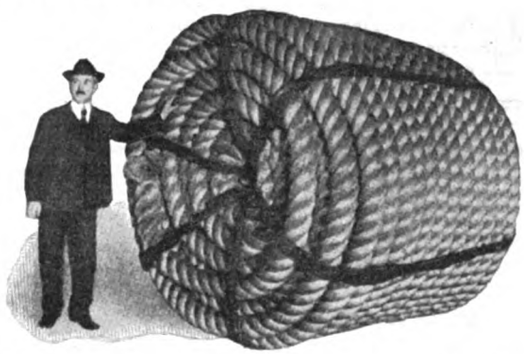
Manila Rope That Wears

When buying rope for marine service quality should be considered first. A small cut on the price will not make up for **40 to 50% longer service** to be had from first-class Manila.



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Buffalo Ship Chandlery & Supply Co.

11 & 13 MAIN ST., BUFFALO, N. Y.

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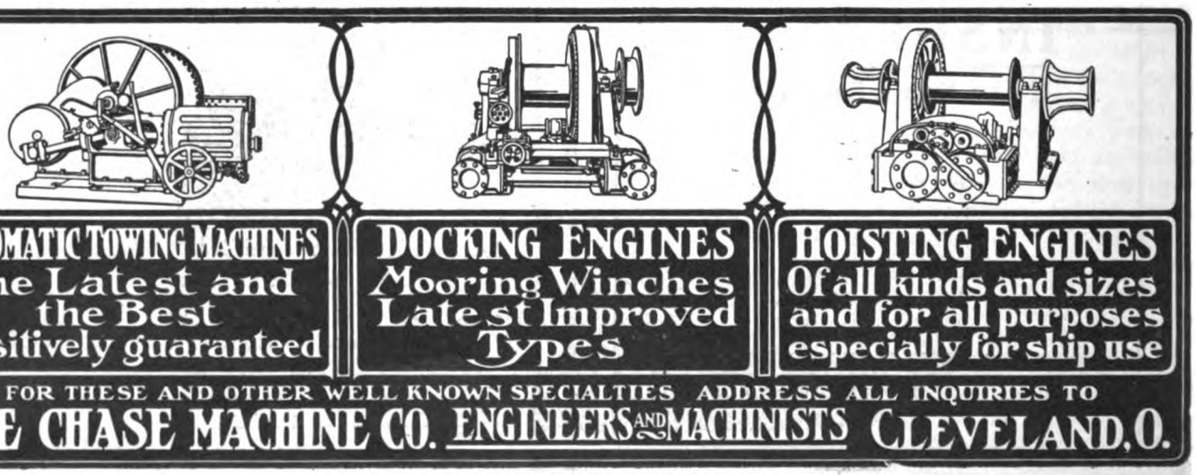
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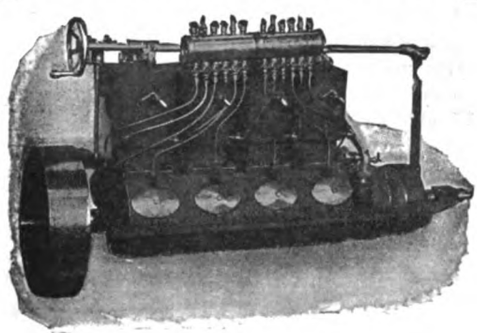

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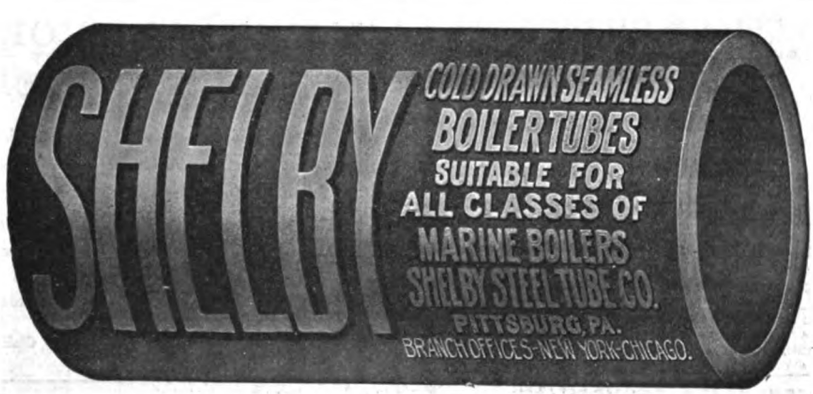

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